

DISEASES OF THE
LARYNX

HAROLD BARWELL



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DISEASES OF THE LARYNX

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DISEASES OF THE LARYNX

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DISEASES OF THE LARYNX

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PREFACE

I WAS glad to have the opportunity of writing this little treatise ; for, though there are several excellent works on the subject of larger size intended for the specialist, it has long seemed to me that there was need of a smaller Manual of Diseases of the Larynx more suitable for the use of the general physician and surgeon and of the student.

I have therefore endeavoured to make the book as concise and practical as possible ; while I have alluded but shortly to the rarer forms of disease and to the more theoretical aspects of my subject, I have described at some length the commoner and more important affections and the practical points of diagnosis and treatment, and I have laid stress on such laryngeal complications as are of importance in general medicine.

To this end, also, special attention has been given to the illustrations, which have been drawn by the

author mostly from cases under his own observation ; the intention has been to picture the more typical appearances as an aid to their recognition and diagnosis. No claim is made to great originality but, on the other hand, little has been written which has not come within the author's personal experience.

In conclusion, I wish to thank the Governors of St. George's Hospital for permission to copy the specimen shown in Plate X, Fig. 2, and Messrs. Mayer & Meltzer for kindly supplying the illustrations of instruments.

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55, WIMPOLE STREET, W.

January, 1907.

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CHAPTER I

INTRODUCTORY

Laryngoscopy.—THE laryngeal mirror is a small plane reflecting mirror, mounted at an angle of 135° , on a handle; one of about 22 mm. or $\frac{7}{8}$ inches in diameter will answer for most cases, but when the pharynx is unusually deep, a larger size, 24 mm., may be necessary to keep the palate and uvula out of the way, and in young children a mirror of about 16 mm. diameter is desirable.

The source of light must be directed as a beam coinciding as nearly as possible with the examiner's line of vision; an electric forehead-lamp provided with a lens, or a concave mirror, and worked by an accumulator is the best portable arrangement. More usually the light is reflected by a forehead mirror; this is concave, with a focus of about 14 inches, and freely adjustable. It must have a

central opening through which the examining eye looks, and is usually worn over the right eye. Almost any source of light will do at a pinch, but a bright light is very necessary for the examination of difficult cases ; I am now using a Nernst electric lamp behind a bull's-eye lens, and find it very satisfactory ; an incandescent gas lamp is also a good illuminant. It is essential that the light be readily movable in every direction.

The patient sits with the body leaning slightly forwards and the head thrown a little back ; the examiner sits so that his own head is on a slightly higher level than his patient's—for this purpose a music stool is very convenient. The light is arranged to the left of the patient's head, a little behind him and at the level of his cranium, and is focussed on to the forehead mirror ; the latter is so adjusted that the beam of light falls on the patient's mouth, and the right eye, looking through the central aperture, has the illuminated area in the centre of its field of vision. This adjustment is rather difficult to the beginner, who may well spend a little time in practising it ; for,

unless the beam of light corresponds accurately with the axis of vision, it is impossible to obtain a properly lighted view of the larynx.



FIG. 1.—Showing position of the examiner's hands when using the laryngoscope.

The laryngeal mirror is now warmed over a spirit lamp until the mist which gathers on its surface

has cleared off. The patient is directed to open the mouth and protrude the tongue as far as possible. The tongue is held in a small cloth with the left hand, placing the thumb on the dorsum and the middle finger on the lower surface ; the index finger is thus left free to rest against the upper incisor teeth, steady the head and, if necessary, retract the upper lip or moustache. The mirror is then introduced, its temperature being always first tested on the back of the left hand ; it is held lightly as one holds a pen, passed well back over the dorsum of the tongue without touching it, and then raised so as to lift the palate, and tilted until a good view of the larynx is obtained.

Difficulties in Laryngoscopy.—*Dependent Epiglottis.* The upper aperture of the larynx looks backwards as well as upwards, and, therefore, to see well into the lumen, the mirror must be brought somewhat behind the larynx by tilting the head backwards ; if this be not done, only the dorsum of the tongue and the anterior surface of the epiglottis is seen, and the latter conceals the interior of the larynx (Figs. 2 and 3). In some larynges the epiglottis

is unduly dependent ; in children it is sharply folded laterally (Plate I, Figs. 2 and 3) ; and it

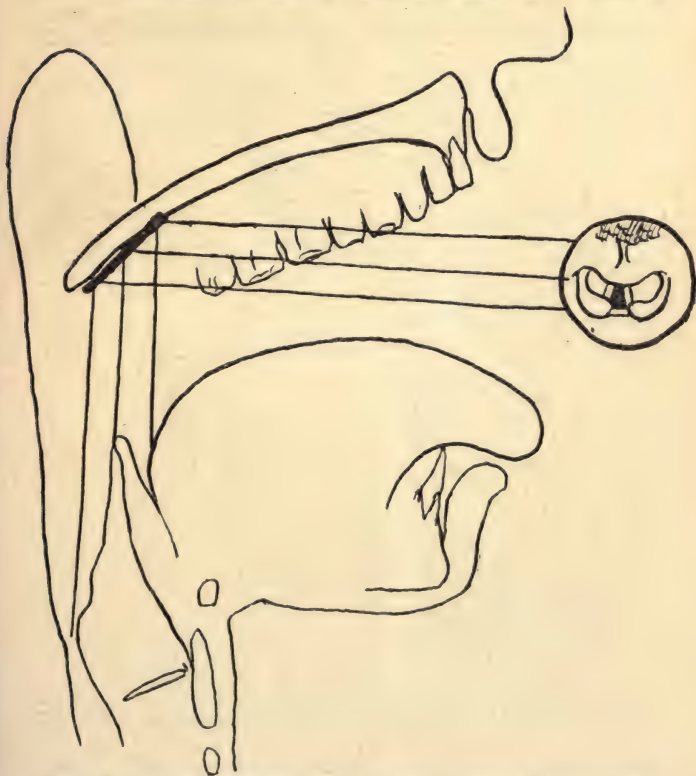


FIG. 2.—Faulty position of the mirror, giving an incomplete view of the larynx.

sometimes retains this shape in adult life. In such cases it is difficult to see the front part of the

cords ; the patient should be told to protrude the tongue as far as possible, as this tends to raise the epiglottis, but it should not be dragged on forcibly.

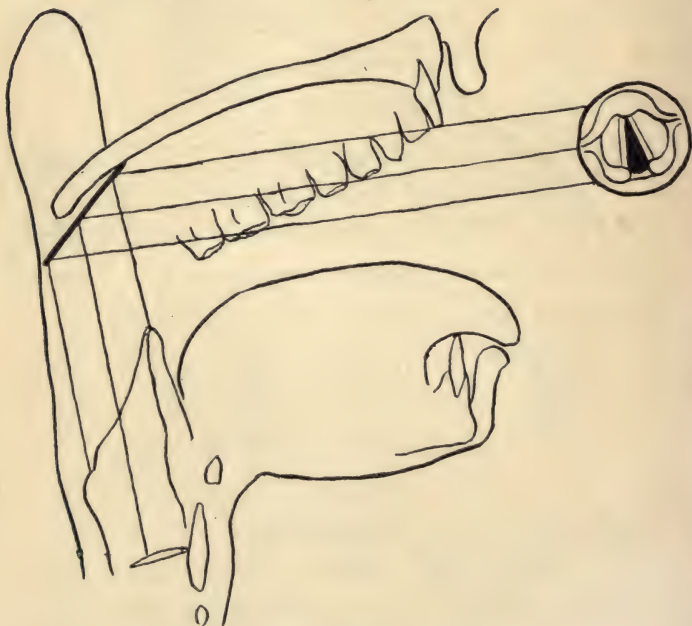


FIG. 3.—Correct position of the mirror.

If the patient sing a high note, the epiglottis is raised ; or, if he be directed to make a prolonged phonation, the larynx can sometimes be well seen

during the involuntary gasp which follows. The larynx is brought into a better position when the patient phonates on the sound "eh," than if he say "ah," as is generally advised. In the still more difficult cases, a curved retractor, placed in



FIG. 4.—Escat's Tongue Retractor.

the glosso-epiglottic fossa, can be used to pull forward the base of the tongue, and with it the epiglottis. Escat's and Mount Bleyer's instruments are convenient for this purpose, and the parts must first be well anaesthetized.

Irritability.—Gagging and retching may occur ; the base of the tongue must not be touched, nor

should the pharynx be tickled with the mirror ; a firm, steady touch is less likely to start the reflex. In some patients, especially alcoholics, dyspeptics and those with pharyngitis, hyperaesthesia is very marked, and the mere protrusion of the tongue may cause retching. Spraying the pharynx with cocaine (5 or 10 per cent.) may be tried ; this is, however, not necessary for examination of normal cases, and is often useless in cases of extreme irritability. It is advisable to apply the cocaine especially to the base of the tongue, where the retching reflex appears to originate. Sipping cold water or sucking ice is also useful. In the worst cases, examination is quite impossible until after a week's course of sedative treatment, saline purgatives, light diet, abstention from alcohol and tobacco, and a simple nasal lotion or spray.

The dorsum of the tongue may be so raised as to completely hide the view ; in such cases, a tongue depressor should be used while the patient holds his own tongue out, or it may be employed without protrusion of the tongue. The tongue should not be pulled on forcibly by the examiner,

but should be gently held directly forwards, and it should never be dragged down over the teeth, for in this way the fraenum may easily be cut. The more it is dragged down in front, the more it will arch up behind.

When an application is to be made to the larynx, or an operation performed, the tongue must be steadied by the patient's right hand, or by an assistant, while the surgeon holds the mirror in his left ; for this reason it is better to learn from the outset to examine with the mirror in the left hand, though in the above paragraphs I have described the more usual method.

To better inspect the *posterior* laryngeal wall, a method recommended by Killian is sometimes of use. The observer sits while the patient, standing above, bends the neck and head down towards him ; the mirror is then introduced in the ordinary way, and in this position gives a less foreshortened view of the posterior wall, and also usually enables one to examine the lower part of the trachea.

Examination in Children.—Inspection of the larynx is difficult in young children, but is usually

possible if he is firmly secured in a blanket and held in the nurse's lap. It is not possible to hold the tongue in the ordinary way, so that Bleyer's or Escat's depressor must be used. The chief difficulty is that mucus and froth obscures the view ; but this may be greatly diminished by the use of cocaine, which must, however, be applied with caution in children ; general anaesthesia is sometimes necessary. Killian's tubular speculum is especially valuable for children.

Autoscopy, or direct inspection, was introduced by Kirstein. The patient sits with the head thrown well back, and the observer stands above him and firmly depresses the tongue with a spatula bent downwards at the end. The advantage is that operations can be performed by direct vision, but the anterior part of the glottis cannot be seen.

Direct Laryngoscopy.—Lately, Killian has introduced a tubular speculum, which is of great value for certain cases, such as the removal of papillomata in children. It is necessary that the head be bent very far back and usually a little to the right side, so that the speculum may lie in the left angle of

the mouth. In adults, the tube may be passed with the patient in the sitting posture, under thorough local anaesthesia ; but in children, at any rate, a general anaesthetic is necessary, the patient being placed in the lateral position, or on the back, with the head hanging over the end of

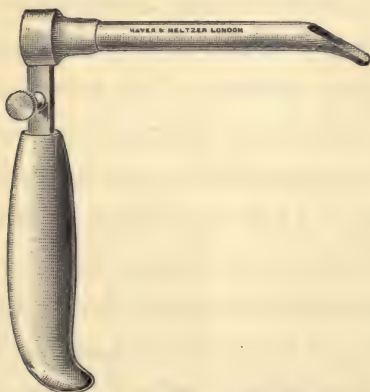


FIG. 5.—Killian's tube-speculum.

the table. The speculum is warmed and introduced until the epiglottis comes into view, when the beak is passed over this organ and a direct view of the glottis is obtained.

Tracheoscopy and Bronchoscopy.—Similar, but longer, tubes are employed, and are used in two

ways : either by the mouth or through a tracheotomy opening. In the former case, the instrument is best passed through a laryngeal tube-speculum, made in two halves, so that it may be removed when the tracheal tube is in place. In some adults the tube may be passed after cocainization of the larynx, the trachea being anaesthetized after the tube has passed the glottis ; in children, a general anaesthetic is required. The tube for an adult measures 9 mm. in diameter, and the distance from the teeth to the bifurcation of the trachea is some 27 cm. (11 in.) ; a tube about 6 inches long is required for examination after tracheotomy. This method has proved of the greatest value in cases of foreign body in the trachea and bronchi.

Anaesthetization of the Larynx.—For endolaryngeal operations, local anaesthesia is necessary. A watery solution of cocaine hydrochloride is still the drug most often employed, and the best effect is obtained by using a fairly strong solution (10 per cent.) and limiting the application strictly to the parts one wishes to anaesthetize. The pharynx should first be anaesthetized with a fine spray, fitted with

a single hand-ball, so that each pressure delivers a definite small quantity, about 1 minim, of the fluid. The solution is best applied to the larynx by means of a small drop-syringe with a curved nozzle, passed under guidance with the mirror while the patient holds out his own tongue. In this way the cocaine is applied accurately to the part to be operated on, and also to the epiglottis, which is likely to be touched by the instrument. After about five minutes, the application is repeated, and after a similar interval the operation may be performed. Altogether some five or six drops are used ; the patient is directed to spit out and not to swallow any of the fluid ; and I have never seen toxic symptoms result from the careful application of this method. The use of a spray or mop to the larynx causes coughing and irritability, which makes the subsequent operation more difficult and, by inducing hyperaemia, hastens the absorption of cocaine.

Certain substitutes for cocaine are now coming into use ; stovaine has the same anaesthetic power as cocaine and is less toxic, it causes slight hyper-

aemia. I have used alypin largely of late ; it is apparently slightly more powerful than cocaine, it keeps well, and may be boiled for a short-time without decomposition ; its toxicity appears to be considerably less than that of cocaine. It produces no constriction of the vessels ; if local anaemia is required, adrenalin must be added.

The Laryngoscopic Image, being reflected in the mirror, is inverted ; the epiglottis appears in the upper part of the picture and the arytenoids in the lower. Of course, the right half of the larynx is still seen on the *patient's* right side. The appearance of the normal larynx is shown in Plate I, Fig. 1 ; as it is seen much foreshortened and viewed with one eye only, the relative levels of the various parts are not easily determined, and the upper aperture appears much less oblique than is in reality the case. The epiglottis is pale, and derives a yellow colour from the underlying cartilage ; it is very variable in shape, but normally presents two curves : one from side to side with the concavity backwards, while the other is in the vertical plane, and consists of a forward curve of

PLATE I.



Fig. 1.—Normal Larynx.



Fig. 2.—Infantile Epiglottis.
To face p. 14.]

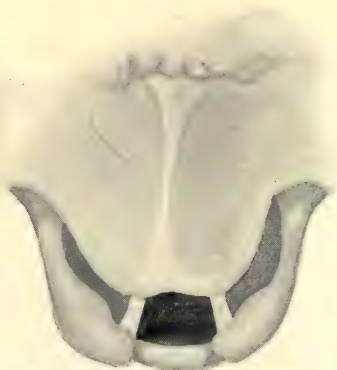


Fig. 3.—Dependent Epiglottis.

its upper half ; thus portions of both surfaces are usually visible in the laryngoscope. At its base it presents a median rounded swelling into the cavity of the larynx, which is called the "cushion of the epiglottis." The lateral borders of the larynx are formed by the aryteno-epiglottidean folds, which curve backwards and inwards, to end each in a bulbous extremity produced by the corniculum laryngis, or cartilage of Santorini, which overlies and conceals the apex of the arytenoid ; external to this a small prominence can be seen, which is due to the cuneiform cartilage of Wrisberg. In the middle line behind is the posterior commissure, or interarytenoid space, which varies in width according to the abduction or adduction of the arytenoids.

In the interior of the larynx the vocal cords are conspicuous ; they are adjacent in front at their attachment to the thyroid cartilage, but diverge behind, and are inserted into the vocal processes of the arytenoids. The cords are perfectly smooth, lustrous and pearly-white in colour, though in some professional voice-users they appear to be normally pink, or even red ; the vocal process is yellowish,

and is sometimes slightly prominent. Above and external to the vocal cord is the false cord, or ventricular band ; this is pink or reddish in colour, and above passes imperceptibly into the lateral wall of the larynx ; below, it is separated from the cords by the narrow slit-like aperture of the ventricle.

The rima glottidis is the narrowest part of the lumen : its anterior two-thirds are formed by the vocal cord, while its posterior third is bounded by the inner surfaces of the arytenoid cartilages. The following may be taken as its average adult size :—

Male. Entire length, 23 mm.

Between cords, 15·5 mm.

Between cartilages, 7·5 mm.

Female. Entire length, 17 mm.

Between cords, 11·5 mm.

Between cartilages, 5·5 mm.

Small in children, it grows till the sixth year, when growth ceases until puberty ; it then increases rapidly in both sexes, but especially in the male. Through the rima glottidis the anterior wall of the

trachea can usually be seen as far as the first few rings ; sometimes the bifurcation of the trachea is distinctly visible.

In front of the epiglottis the base of the tongue may be seen ; the median and lateral glosso-epiglottic folds connect the two, and the two fossae between these folds are termed the valleculae. The pharynx surrounds the back part of the larynx, its posterior wall is in contact with the arytenoids hiding the orifice of the oesophagus, but on either side it is kept open by the ala of the thyroid cartilage to form the fossa pyriformis.

The *movements* of the larynx in respiration and in phonation should be observed. The cords are practically motionless during quiet respiration, but on breathing deeply a rhythmical movement is observed, the cords abducting widely on inspiration and approaching each other during expiration. On phonation the cords should lie parallel, with their free margins almost touching, and the arytenoid cartilages should come together so as to obliterate the interarytenoid space. The position of rest, or quiet respiration, is maintained by the

tonic action of the abductor muscles, for the glottis is wider than in the "cadaveric position," assumed after death or after destruction of the recurrent laryngeal nerve. Thus, according to Semon, the average width in an adult man is 13.5 mm., whereas after death it averages only 5 mm. As was first shown by Anderson Stuart, the epiglottis does not fold backwards to protect the larynx during deglu-

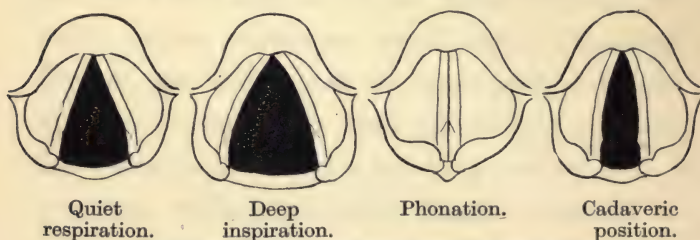


FIG. 6.—The various positions of the cords.

tition, and it may be completely destroyed without interference with the action of swallowing. In reality, the larynx is closed by the arytenoids, which are adducted and tilted forwards against the cushion of the epiglottis.

The mucous membrane of the larynx is very thin and adherent over the vocal cords ; it is also firmly attached to the epiglottis ; whereas it is

thickest, and the submucous tissue is most abundant, on the aryteno-epiglottidean folds. The epithelium is ciliated below the vocal cords and in the ventricles ; ciliated epithelium is also found over the lower half of the epiglottis in the middle line and in patches on the lateral walls ; elsewhere the covering is of the stratified squamous variety. Mucous glands are irregularly distributed, being especially plentiful on the arytenoids, base of the epiglottis, and within the ventricle. Minute glands even occur sparsely on the vocal cords.

Congenital Abnormalities.—In the infantile type of larynx the epiglottis is sharply folded on itself, so that its two sides are almost in contact ; this shape not infrequently persists to some extent through life, and makes laryngoscopic examination difficult. It is to an exaggeration of this infantile type that congenital laryngeal stridor is due (*see* p. 191). The shape of the epiglottis is extraordinarily variable, and a tendency to bifidity is sometimes seen.

An uncommon but important abnormality is the *congenital web*. This is the remnant of the epiblastic tissue which in foetal life fills the glottis

and is absorbed from behind forwards. It is placed at the level of, or immediately below, the cords ; and, though it never occupies the cartilaginous glottis, it may stretch between the entire length of the true cords, or may be confined to the anterior commissure. New growths in this latter situation are possibly developments of this tissue. The symptoms are hoarseness and dyspnoea, and the subject is referred to again on page 190.

CHAPTER II

INFLAMMATION

ACUTE CATARRHAL LARYNGITIS

Aetiology. — This common affection generally occurs as part of an ordinary “cold,” the inflammation spreading down to the larynx from the nose or naso-pharynx ; in other cases it may start in the larynx and be set up by the inhalation of dust or irritating vapour, or by overstrain of the voice. There is little doubt that coryza is infectious, due possibly to a variety of micro-organisms, and that chilling of the body is but a predisposing cause. All causes of mouth-breathing and nasal obstruction are strongly predisposing, as also are sedentary occupations, hot and stuffy rooms, gout, rheumatism and alcoholism. Laryngitis is also a complication of many specific fevers, notably influenza and measles (*see* Chap. IX), and consumptives are very

subject to laryngeal catarrh irrespective of local tuberculous infection.

Symptoms.—These consist in hoarseness or aphonia, some local discomfort, burning, dryness, or even pain, and irritable cough. There is little expectoration unless the trachea is involved, in which case the feeling of discomfort extends downwards to the sternum. At the onset there may be slight feverishness and malaise. The degree of hoarseness is by no means always proportionate to the objective appearances ; the voice may be quite good with marked hyperaemia, and may be completely lost when little abnormal is to be seen ; this depends partly on infiltration of the muscles and partly on the tendency to functional aphonia. In some voice-users redness of the cords appears to be normal, and causes no interference with function.

Objective Appearances.—The larynx is reddened, and this is most noticeable on the parts ordinarily pale, the vocal cords and epiglottis ; the redness is usually diffuse, but may be somewhat patchy. Marked hyperaemia of one cord is sugges-

tive of more serious disease, syphilis, tubercle, or early epithelioma ; it may also be due to traumatism or gouty inflammation, but does not occur in simple catarrh. There is often much proliferation and superficial necrosis of epithelium, and slightly raised white patches may be seen, especially a semi-circular area on the centre of each cord, on the spot where vibration is greatest and where innocent growths generally occur. Elsewhere the patches are less circumscribed, and small, very superficial erosions may be found on the parts subject to attrition, especially the vocal processes and interarytenoid space. A small amount of mucous secretion is generally present, but in acute catarrh no large accumulations or strings of mucus as in chronic laryngitis ; a minute globule of mucus may often be seen to form during phonation on the middle of the cord, just where singers' nodule occurs, and, indeed, it may closely imitate this little outgrowth. The vessels on the epiglottis may be unduly prominent. The tracheal mucosa may be reddened and patchy to a variable extent, and in some patients the catarrh always spreads to the

trachea and bronchi. In severer forms there is distinct swelling, seen especially where the submucosa is loose, on the ary-epiglottic folds and interarytenoid space (*see* Plate II, Fig. 1).

In the slighter or subacute grades, which present themselves for treatment chiefly in professional voice-users, frequently the only abnormality to be seen is some redness of the cords ; sometimes they are merely yellowish, with the loss of their normal white pearly lustre. There is often a little swelling, which shows itself by the fact that, on phonation, the cords come into contact at the centre instead of leaving the usual narrow parallel chink ; and on this point, where the amplitude of vibration is greatest, the little mucous globule referred to above may form. The tendency of the cords, when swollen, to meet at the mid-point explains the frequency with which singers' nodules and other innocent growths occur at this spot.

In Children, acute catarrhal laryngitis is a far more serious affection, for dyspnoea may come on at any time with great suddenness ; and the younger the child, the worse the prognosis. There

is a much greater tendency to oedema, especially of the subglottic region, and also to spasm of the glottis. Constitutional disturbance is more marked, with rapid pulse and respiration and a febrile temperature ; the latter is seldom very high, but generally averages about 101° F. As with all laryngeal diseases in children, the symptoms are worse at night.

SPASMODIC LARYNGITIS

(Laryngitis Stridula)

This is simply catarrhal laryngitis, in which spasm of the glottis is a marked feature ; it is therefore a disease of childhood. The onset is that of an ordinary catarrh, with slight feverishness and a frequent cough. The child is suddenly awakened in the middle of the night by a fit of coughing, which is loud and ringing. Spasm of the glottis follows, with inspiratory stridor, retraction of the epigastrium and lower ribs, and all the signs of asphyxia, which persist until death appears imminent ; the spasm then subsides, and the child usually goes to sleep. The attack may or may

not recur the same night ; in the day the symptoms improve. The spasm usually recurs for the next few nights, but nearly always with diminishing severity ; whereas in diphtheria the symptoms, also more marked at night, tend to become worse for several nights in succession. Laryngismus stridulus is a purely spasmodic affection ; there is no catarrh, and therefore no hoarseness or other symptoms between the attacks.

OEDEMATOUS LARYNGITIS

Acute inflammation may proceed to marked oedema, but in adults this is rarely the result of simple catarrh ; it more often occurs in acute septic laryngitis or as a sequela of enteric fever, scarlet fever, influenza and small-pox (Chapter IX), or as the result of secondary infection in syphilitic tuberculous or malignant disease. I have seen marked oedema of the epiglottis in a case of pneumonia in which only the pneumococcus was found in the sputum. The oedema may be general or localized to the epiglottis, arytenoids or subglottic region ; when the upper aperture is affected there

is marked dysphagia, and dyspnoea may result from swelling of this or the subglottic region. The affected parts are seen to be reddened, swollen and rounded, with loss of their usual contour and of a typical translucent appearance. The symptoms are similar to those of acute catarrh, but are more pronounced, with more fever, constitutional disturbance, pain, and dyspnoea.

In children oedema is not uncommon as a result of catarrhal inflammation, and for this reason such affections are of greater importance in patients of a tender age. Dysphagia is uncommon in children; the principal symptom is dyspnoea, which may come on with great rapidity.

For non-inflammatory oedema, *see* p. 180.

ACUTE SEPTIC LARYNGITIS

These affections are not due to one specific micro-organism, but may be produced by many varieties, especially by the streptococcus pyogenes, streptococcus erysipelatos, and various forms of staphylococcus. Clinically the inflammation may be superficial (erysipelas laryngis), membranous,

oedematous, suppurative or phlegmonous, and gangrenous. Debilitated persons are predisposed, but the affection often attacks those in robust health and for no apparent cause ; sometimes it is the sequela of an acute infectious fever. The affection may be primary in the larynx, but often spreads thither from the fauces or pharynx, or the larynx may be involved as part of an "angina Ludovici."

The onset is sudden, with a rigor ; the temperature is generally high, of the hectic type, with frequent rigors and profuse sweats ; but sometimes the course is more characteristic of erysipelas, with a continuous high temperature and a fall by crisis. All the signs of septic absorption are present, such as albuminuria, diarrhoea and delirium ; local or pyaemic abscesses may form and pneumonia is not uncommon. In the worst cases the fever may assume the asthenic type with low muttering delirium, dry brown tongue, twitchings and coma.

The earliest symptoms are pain and dysphagia ; when the larynx is attacked, hoarseness is soon followed by aphonia and dyspnoea. The affected

parts of the larynx are intensely hyperaemic, of a dark purplish colour, or bright red in some of the slighter superficial cases ; there is much swelling and oedema, and abscess and necrosis are frequent. Severe, and even fatal haemorrhage may result from deep extension of the ulceration. The prognosis is extremely grave ; if the inflammation has extended deeply, and if necrosis of cartilage has taken place, recovery is necessarily very tedious with a great tendency to stenosis.

CHRONIC LARYNGITIS

Aetiology.—Simple chronic laryngitis is often the result of recurrent or persistent acute catarrh. The chief factors in its causation are nasal obstructions and suppurations ; working in stuffy or dusty rooms ; overuse of the voice or incorrect voice-production ; dyspepsia, especially combined with abuse of alcohol or tobacco ; anaemia, rheumatism and gout. It is often associated with catarrh of the nose or pharynx, and also of the trachea and bronchi.

Symptoms.—The principal symptom is impair-

ment of the voice, which is hoarse and easily tired or at times completely aphonic ; it is usually worse in the evening after use, but is sometimes at its worst on rising in the morning, especially in the dry forms associated with mouth-breathing and nasal disease, in which cases it frequently improves after breakfast. There is not uncommonly some local discomfort, dryness, tickling or a feeling of swelling ; and there is often a cough, but little expectoration unless the trachea or bronchi are inflamed.

Objective Appearances.—The redness of the larynx is more patchy and less evenly distributed than is the case in acute catarrh ; there is usually no marked thickening in simple cases, but all gradations up to decided pachydermia are to be found. The cords have lost their normal pearly lustre and are variously grey or pink ; enlarged vessels may be seen on their surface, and they are generally somewhat thickened and rounded at the edge. The vocal process is often prominent and may appear white against the injected cord ; in other cases its neighbourhood is distinctly reddened.

The ventricular bands are sometimes swollen, obscuring the outer edge of the cord.

The mucous membrane over the interarytenoid region is generally relaxed. The epiglottis is often injected so that its yellow edge stands out clearly, and enlarged vessels are seen on its surface. Collections of mucus are frequently seen about the larynx, and strings of sticky mucus may stretch between the cords ; such an appearance is very characteristic of chronic, as distinguished from acute, catarrh. A globule of mucus may also form during phonation at the centre of the cord. The name "laryngorrhoea" has been used for cases where the mucous secretion is very excessive.

Occasionally the mucous membrane, especially over the arytenoids and ary-epiglottic folds, presents numerous small projecting granules, due to enlargement of the mucous glands ; this condition has been called *granular laryngitis*. The glandular tissue immediately beneath the cords at the anterior commissure may also be enlarged and form a small red mass which prevents the proper apposition of the cords. The movements of the cords are fre-

quently impaired ; they may act jerkily or there may be distinct paresis of the thyro-arytenoidei or other adductors ; this is partly the result of infiltration of the muscles and of thickening of the mucosa, and partly the effect of functional paralysis due to the increased effort required for phonation.

Laryngitis Sicca.—This form is usually, but not invariably, associated with rhinitis sicca or atrophica and dry pharyngitis ; small brown crusts adhere to the cords and posterior commissure and, when brought away by coughing, may give rise to haemorrhage.

Atrophic Laryngitis.—In this form, which merges into the former, the crusts are large, green, brown or black, and often foetid ; they may extend into the subglottic region and down the trachea, and cause urgent dyspnoea which has proved fatal in more than one case. The affection is nearly always associated with atrophic rhinitis. Ulceration occurs beneath the crusts and granulations may form ; the picture, before the crusts are removed, is sometimes very similar to that of tuberculous laryngitis.

Haemorrhagic Laryngitis.—This is not really a definite pathological entity. Haemorrhage, either submucous or external, may result from various causes, such as acute and septic inflammations, especially when occurring as a complication of a severe infectious fever ; or it may be a result of the separation of crusts in dry and atrophic laryngitis. Over-strain of the voice may rupture a vessel on the cord ; in this case the extravasation will be submucous and cause a dark purple patch on the cord, and this has in rare cases been sufficiently prominent to imitate a tumour.

Pachydermia Laryngis.—The nature and causation of this important affection is still something of a mystery. It is probably not so much a separate disease as a development of chronic laryngitis. It is much commoner in men than in women, and is a disease of later middle life. Störk, as well as most English authors, is of opinion that alcoholism is the chief factor in its production ; Schmidt believes that it occurs only in association with dry rhinopharyngitis, and is of the nature of a corn resulting from the frequent cough. Gougenheim considers that it

is tuberculous ; apart from tuberculous laryngitis pachydermatous thickening of the posterior commissure is fairly common in consumptives, and I believe that it may be due to the cough and the irritation of the sputum without, of necessity, any infection by the tubercle bacillus (see Chapter IV) ; the same condition is found in cases of chronic nasal suppuration, when pus trickles down into the larynx.

Objective Appearances.—The essential process is a thickening of the epithelial and subepithelial tissues, and it affects chiefly the vocal processes, cartilaginous glottis and posterior commissure. A circumscribed swelling appears on each vocal process, and at the apex of this a small depression or umbilication develops, either because the mucosa is here adherent to the cartilage, or as a result of the pressure of the opposite vocal process at this spot. The cords come into apposition better than one would expect from the size of the swelling, because the prominence on one side fits into the depression on the other, and in doing this the left vocal process usually lies below the right. Erosions,

and even definite ulcers may form, generally on the upper surface of the left and on the lower surface of the right vocal process. The cords are generally thickened and sometimes covered with a diffuse warty mass; this condition, *pachydermia verrucosa*, is essentially similar to the formation of multiple papillomata. Singers' nodules (see Chapter V) may be described as a form of pachydermia. A similar epithelial thickening is found in the interarytenoid space; at first this region appears as if covered with a thin grey pellicle, which wrinkles on adduction of the cords, but is smoothed out again on wide abduction. Later these wrinkles become permanent, and the thickening increases so as to fill the angle between the posterior wall and the inner surface of the arytenoid; it is more or less symmetrical and leaves in the middle line a gap or fissure; the surface may be smooth or finely crenated. In colour the thickenings are pink, grey or of a very opaque white tone (see Pl. II, Fig. 2).

Diagnosis.—Pachydermia may closely resemble some forms of tuberculous laryngitis, and the

interarytenoid thickening is sometimes indistinguishable by inspection alone (*see* Chapter IV). The pachydermatous outgrowths are, however, typically firm and opaque like thickened skin; they are symmetrical and leave the characteristic central depression, whereas tuberculous infiltration here is soft, semi-translucent and irregular. When marked erosions are present on the vocal processes syphilis may be imitated; the erosions, however, do not extend, their edges are not sharp-cut and hyperaemic, and the symmetrical interarytenoid thickening is usually present as well; the interlocking of the prominences on phonation is very characteristic of pachydermia.

TREATMENT OF SIMPLE INFLAMMATION

Acute Catarrhal Laryngitis.—Cases suffering from the slighter degrees of this affection seldom present themselves for treatment unless they are professional voice-users. The laryngitis usually occurs as part of an ordinary cold which, at its earliest onset, may be aborted or much modified if the patient consider it worth while. He must

be kept in a warm room, the bowels should be opened with a smart purge, and free diaphoresis obtained ; for this purpose a variety of drugs are employed, such as Dover's powder 10 to 15 grains, chlorodyne 10 to 15 minims, ammoniated tincture of quinine 1 to 1½ drachms, salicylate of quinine 5 grains in a cachet, or the household remedy of hot whisky and water. Such treatment is useless when the attack has developed ; if then the larynx is affected, complete rest of the voice should be enjoined, alcohol and tobacco forbidden, and the patient should be confined to his room, the temperature of which should not be allowed to fall below 65° F. Heat or cold may be applied externally by means of compresses or Leiter's tubes ; of the two cold is usually preferred, especially in severer cases. Sedative steam inhalations, such as Friar's balsam, benzoic acid or menthol, are of value, but the patient must avoid all exposure to cold after their use. Later on, and when the patient cannot keep his room, I much prefer a good atomizer giving a fine spray, preferably of an oily solution ; sedatives, especially menthol, should be used at first in the atomizer,

and later more stimulating drugs, such as camphor, oleum eucalypti, oleum pini sylvestris, chloretone, resorcin, etc. (*see* Appendix). The nose and nasopharynx are usually affected at the same time, and a simple alkaline nasal douche will do good.

Internally, ammonium chloride gr. v, vinum ipecacuanhae ℥v to x, or oleum cubebae ℥v in syrup, every four hours may be of value. The calomel treatment is to be recommended; a purgative dose, three to five grains, is first given, and the drug is then continued in half-grain doses every four hours. If the cough is severe it should be restrained, as it causes increased congestion of the cords; for this purpose heroin is most valuable in doses of gr. $\frac{1}{2}$ to $\frac{1}{6}$ in a linctus of glycerine and water; opiates may be necessary, given in the form of liquor morphinae ℥ii. to iv. in a linctus with hydrocyanic acid.

In cases of subacute catarrh in voice-users expectorants are indicated to moisten and lubricate the vocal cords. Lennox Browne recommended the following prescriptions:—

Pil. scillae comp.	.	.	.	gr. ij.
Pil. ipecac. comp.	.	.	.	gr. i.
Pil. rhei comp.	.	.	.	gr. iss.

Ft. pil. i. Two to be taken night and morning, and one at intervals during the day if necessary.

Ammonii carb.	.	.	.	gr. ij.
Tinct. scillae	.	.	.	℥x.
Tinct. digitalis	.	.	.	℥v.
Liq. strychninae	.	.	.	℥ij.
Infus. cascarillae	.	.	.	ad ʒi.

Or ipecacuanha and tartar emetic, gr. $\frac{1}{100}$ of each, in a tablet, every five or ten minutes until expectoration is free or nausea produced.

Professional singers and speakers often wish to know if they may use the voice while suffering from catarrh: this should certainly be forbidden when the cords are reddened, for it will do harm and may permanently impair the voice. If the occasion is a very important one, something may be done to allow a catarrhal larynx to be used, but the risk must be made clear to the patient. The bowels should be freely opened with a dose of calomel, and the patient must keep absolute silence until

the time arrives ; if the cords are dry and dull, the tablet given above should be prescribed. Watson Williams recommends the following pastil :—

Atropinae	.	.	.	.	gr. $1\frac{1}{20}$
Morphinae.	.	.	.	.	gr. $\frac{1}{12}$
Cubebae	.	.	.	.	gr. $\frac{1}{2}$
Hydrarg. iodid. viridis	.	.	.	.	gr. $\frac{1}{60}$

One pastil every four hours until six have been taken.

An oily solution may be used in the nebulizer, containing menthol and camphor, with the addition of one per cent. of cocaine ; but if mucous secretion is free the following spray is preferable :—

Cocaine hydrochlor.	.	.	.	gr. v.
Adrenalin chloride (1 in 1,000)	.	.	.	℥xlvi.
Glycerine	.	.	.	ʒij.
Water	.	.	.	ʒi.

Half an hour before the performance a hypodermic injection of strychnine may be given.

In children acute laryngitis always requires careful attention on account of the risk of asphyxia from spasm or oedema. One or two grains of calomel should be given every three hours until the bowels have acted freely, and the drug may be

usefully continued in half-grain doses three times a day. Hot fomentations to the neck and a steam kettle are advisable, and in acute febrile cases tincture of aconite and vinum antimoniale, one minim of each, should be given every three hours. If any dyspnoea appears, or if the expectoration is viscid, an emetic dose of ipecacuanha often gives rapid relief, ten or fifteen minims of the vinum every quarter-hour until vomiting occurs. Blood-letting by means of a leech may be tried; one or more should be applied over the manubrium sterni rather than to the neck, so that too free bleeding can be arrested by pressure.

Oedematous Laryngitis.—If oedema occurs the cold coil or ice-bag should be applied to the neck, and a spray of adrenalin, 1 in 5,000 or stronger, may be tried, but free scarification of the swollen arytenoids must be practised without much delay. In adults this can generally be done with a laryngeal lancet guided by the mirror; but in children it is best performed with a sharp-pointed curved bistoury, guarded with strapping to within half an inch of the point; the left forefinger is passed down

to the swollen part and the knife passed along it. If scarification is insufficient, or if the swelling is out of reach in the subglottic region, tracheotomy or intubation must be performed as soon as asphyxia is well marked. Opinion differs widely as to which of these two operations is to be preferred ; intubation may be best in children provided that a medical man is always near at hand, but the oedema of adults is generally due to septic laryngitis or perichondritis ; the stenosis lasts a considerable time and the pressure of the tube may do harm (*see* p. 200). A low tracheotomy should be performed, for the subglottic swelling may extend for some distance down the trachea.

Septic Laryngitis is to be treated on precisely similar lines. The general strength must be supported by nutritious diet, strychnine, digitalis and alcohol if necessary. Perchloride of iron has been considered almost specific for such inflammations : it should be given in half-drachm doses of the tincture every four hours ; quinine in doses of five or more grains may be used instead. Locally,

insufflation of orthoform, or a spray of cocaine, must be employed to relieve the dysphagia. Scarification is seldom possible on account of the great swelling of the fauces and pharynx, and for the same reason intubation is impracticable and undesirable, but tracheotomy must be performed early if oedema ensues.

Spasmodic Laryngitis.—In addition to the ordinary treatment of the laryngitis the spasm should be combated by small doses of nitroglycerine, gr. $\frac{1}{500}$ every three hours, or by atropine, or by the bromides or iodide of potash. An emetic dose of ipecacuanha is often most useful, and, during the spasm, the inhalation of nitrite of amyl, 1 to 3 minims, from a capsule. Intubation or tracheotomy is rarely called for.

Chronic Catarrhal Laryngitis.—If catarrh recurs frequently, or persists and tends to become chronic, careful attention must be paid to the general health. Out-door exercise, plenty of fresh air and a daily morning tepid or cold bath indicate the direction which treatment should take, and with the exhibition of tonics, such as strychnine,

will often enable the patient to throw off an obstinate catarrh.

In the treatment of chronic catarrh any constitutional disturbance, such as anaemia, indigestion or gout, must receive attention. Over-indulgence in tobacco and alcohol, and the use of ill-ventilated rooms and exposure to dust must be considered ; with teachers the black-board chalk is an important factor, and the substitution of a damp sponge for the dry duster may have a remarkable effect.

The voice must be rested as much as possible, and when the affection is so severe in a professional voice-user as to incapacitate him from work, complete silence and the use of a slate and pencil should be enjoined. Incorrect vocal production is a frequent cause of laryngitis, and a course of lessons in elocution may do much to improve the voice of a public speaker ; but it is difficult for the doctor to advise a professional singer on this point. As a rule the fault lies in forcing the voice too much in the larynx and in insufficient use of the nasal resonance. Holbrook Curtis' ¹ vocal exercises are

¹ *Voice Building and Tone Placing.*

designed to correct this error and are most useful ; the principle is to begin by humming a note and bringing the resonance forward to the front of the palate, then finally by dropping the jaw and opening the mouth, to bring the sound well out on the lips.

Any source of nasal obstruction, catarrh or sup-puration must be carefully sought for and treated, and any concomitant pharyngitis should also receive attention.

Internally, small doses of potassium iodide, or the yellow proto-iodide of mercury, gr. $\frac{1}{16}$ three times a day, may be given. When the muscles act badly, strychnine is of value.

Locally, a stimulating solution in the nebulizer should be ordered, and in some cases local astringent applications with a mop. These latter are especially useful when there are hypertrophic changes ; chloride of zinc, 15-30 grs. to the ounce ; perchloride of iron, 5-30 grs. to the ounce ; or nitrate of silver, 10-50 grs. to the ounce ; the latter is the most painful and usually requires cocaine. In all cases the weaker solution should be used at first, and the

strength only gradually increased ; and the application must be made daily or every other day, and often for a considerable time.

Pachydermia Laryngis should be treated on similar lines : avoidance of excessive alcohol or tobacco, rest, astringent sprays, potassium iodide or yellow iodide of mercury. Locally, silver nitrate in solution or fused on a probe and carefully applied to the part required may be tried ; or an alcoholic solution of salicylic acid, as recommended by Dundas Grant, beginning with one per cent. and increasing daily by one up to six or eight per cent. if necessary. The cautery or cutting forceps are very seldom advisable, and only when a definite projection prevents the approximation of the cords. The treatment of singers' nodules is discussed in Chapter V.

Laryngitis Sicca should be treated by oily applications in the nebulizer and by the exhibition of expectorants (p. 39). Intratracheal oily injections are of great value, and any associated disease of the nose must receive attention.

PERICHONDritis

This affection is usually due to secondary infection with pyogenic organisms in the course of tuberculosis, syphilis, or malignant disease ; it is also found as a complication of typhoid fever, small-pox and other infectious fevers, and occurs in septic laryngitis ; occasionally it is the result of traumatism from swallowing a sharp or hard body or from the rough passage of an oesophageal bougie. Very rarely it occurs as an apparently primary or idiopathic affection, and no better cause than "cold" can be discovered.

Any of the cartilages may be attacked ; in tuberculous cases the arytenoid is generally affected, and in the simple inflammatory forms the cricoid cartilage. The disease is usually acute, leading to suppuration and necrosis, but a chronic hyperplastic form occasionally occurs.

Arytenoid perichondritis appears as a rounded swelling ; the infection generally enters at the vocal process where the mucosa is thin and adherent, and when pus forms the abscess ruptures at this point.

Necrosis may be limited to the vocal process or the entire cartilage may be exposed in a deep cavity. It may slowly become loose and be thrown off, and recovery may then take place.

Epiglottic perichondritis is probably a common accompaniment of tuberculous or syphilitic disease of the organ, but causes no special manifestations. In suppurative cases the epiglottis forms a large rounded swelling and the pus finds exit at the margin or on the laryngeal surface.

Thyroid perichondritis may result from any of the above causes, but it also occurs as a rare but important form of primary laryngeal tuberculosis. The swelling may be external or internal, or both ; if internal it produces a unilateral swelling of the lateral wall and ventricular band with early fixation of the cord and hoarseness (Pl. II, Fig. 3). If external there are tenderness and swelling over the ala of the thyroid cartilage with obliteration of the sharpness of its borders. The abscess may rupture internally or ramify widely in the neck.

Cricoid perichondritis usually affects the posterior plate of the cartilage ; if the inflammation is ex-

PLATE II.



Fig. 1.—Acute Laryngitis.



Fig. 2.—Pachydermia.



Fig. 3.—Perichondritis of Thyroid and Arytenoid.



Fig. 4.—Cricoid Perichondritis.



ternal the swelling projects backwards into the lower end of the pharynx, while if it is internal there is swelling of the posterior laryngeal wall above and below the cords, and often marked unilateral or bilateral subglottic oedema (Pl. II., Fig. 4).

The Symptoms are hoarseness, dyspnoea, dysphagia, especially when the cricoid, arytenoid or epiglottis is attacked, and tenderness on palpation in affections of the thyroid or cricoid cartilage. Exfoliation is extremely slow and the patient, if he survive the acute stage, becomes much exhausted by pain and discharge. Severe and intractable stenosis is likely to ensue after healing takes place.

Treatment.—An abscess of the arytenoid or epiglottis can be opened by intra-laryngeal methods ; it is best to punch away part of the abscess wall so as to insure drainage, and the diseased cartilage can also be removed with punch-forceps. Perichondritis of the thyroid or cricoid should be attacked through an incision in the neck and treated on general surgical principles, any necrosed cartilage being removed. Urgent dyspnoea may call for

tracheotomy. The subsequent stenosis must be treated by dilatation or by thyrotomy (*see* Chapter VII).

DISEASES OF THE CRICO-ARYTENOID JOINT

Fixation, apart from paralysis, may result from inflammation in or around the joint, due to perichondritis, the infectious fevers, rheumatism, gout, tubercle, syphilis, cancer or traumatism. The cord may be fixed in any situation, but usually assumes the cadaveric position. The voice is hoarse and easily tired, but is generally stronger than in cases of recurrent paralysis, where the movable arytenoid is pushed away by its fellow. The diagnosis from paralysis is discussed on p. 154.

Dislocation is a very rare result of disease of the joint; the arytenoid is displaced forward, the cord and ventricular band are lax and wavy, and marked deformity is the result.

MEMBRANOUS LARYNGITIS

A membranous exudation may be produced

by scalds, caustics, or cauterizations, but it is more often the result of the action of micro-organisms.

The term "croup" was introduced before the era of the laryngoscope to describe a group of symptoms consisting of laryngeal obstruction, hoarseness, and the peculiar hoarse or "croupy" cough. These symptoms may be caused by many diseases, such as membranous laryngitis, acute and spasmodic laryngitis and laryngismus stridulus; the cases with membrane were then called "true croup," and the others "false croup," but it is better not to employ the term at all, as its meaning is so inexact.

Membranous laryngitis is usually due to the diphtheria bacillus, but there is now no doubt that a membranous exudation may be caused by other organisms, especially the streptococcus, either as a primary affection or as an occasional complication of the acute specific fevers, such as typhoid or scarlet fever (*see* Chapter IX).

Diphtheria is fully described in works on general medicine, and will be very shortly dis-

cussed here. It is very rarely primary in the larynx, but is apt to extend thither from the fauces in children, much more rarely in adults. Extension to the larynx is now much less common since the general use of antitoxin, and if a sufficient dose has been administered before the larynx is implicated it may be safely said that it will not subsequently become affected.

The larynx cannot always be examined, especially in young children and when dyspnoea is urgent; when an examination is possible the exudation will be seen lying on an inflamed reddened mucous membrane; it is generally less firmly adherent than it is on the fauces.

The symptoms are hoarseness and cough, loud at first, but later becoming hoarse and "croupy." Laryngeal obstruction then ensues; it is paroxysmal in character, and there are, in the early stages, intervals of quiescence; it is usually worse at night, and gradually increases in severity, and it is accompanied by recession of the lower ribs and epigastrium. At first the child is intensely restless, but, if the obstruction is

severe, cyanosis ensues and the patient becomes drowsy and ceases to struggle for breath.

As the fauces are nearly always first affected, the diagnosis is rarely in doubt. In the rare primary cases the enlargement of the cervical glands and the albuminuria will help to distinguish the affection from acute laryngitis or spasm. The disease is asthenic in character, the temperature seldom rising above 103° , the pulse is rapid and small, and enfeeblement progressive. In non-diphtheritic membranous laryngitis the temperature rises higher and more rapidly, and the disease is at first of the sthenic type; but the differential diagnosis can only be made by thorough bacteriological examination. Children seldom cough up the membrane, unless tracheotomy has been performed.

Of general treatment it need only be said that antitoxin must be given early and in large doses. Emetics should generally be avoided as depressing, but if there is much dyspnoea at an early stage an emetic dose of *vinum ipecacuanhae*, 10 or 15 minims every quarter of an hour, will often do

good. The local application of antiseptics is hardly practicable in young children; spraying with antitoxin has been recommended by Lenszer. A steam-tent is usually employed. Moritz Schmidt strongly advises the application of ice to the neck; it should not be left on for more than three or four hours, and is contra-indicated when the temperature is subnormal. Many practitioners prefer a hot fomentation. Intubation or tracheotomy should not be long delayed when there is dyspnoea, especially as the obstruction throws a very great strain on a heart already weakened by the disease. The choice between intubation and tracheotomy is largely a matter of opinion; the former should, however, only be preferred where a medical man is constantly at hand (*see* Chapter VIII).

The prognosis is grave, though the use of antitoxin has reduced the mortality from about 60 to under 30 per cent. in cases requiring tracheotomy or intubation. The earlier the case is seen, and the sooner the injection is given, the better is the prognosis.

Non-diphtheritic **Membranous Laryngitis** occurs especially in children between the ages of two and eight years, but a mild form is also found in young adults, and a membranous deposit is not uncommon in cases of acute septic laryngitis. Membranous laryngitis is generally primary in the larynx, but the fauces may be first affected.

The onset is more sudden than that of diphtheria; the first symptom is hoarseness; the brassy cough soon appears and is generally accompanied by spasm, so that signs of obstruction rapidly ensue. The little patient is restless, and the temperature rises rapidly, and usually reaches 103° to 104° . The attacks of dyspnoea come on at night, and the symptoms abate towards morning, as is usual in laryngeal affections where spasm plays an important part; they recur the next evening, and the severest stage may not be reached for a day or two. When partial asphyxia occurs the temperature falls, the pulse becomes small, and the disease assumes an asthenic type.

In primary cases careful examination may be required to distinguish the case from one of

spasmodic laryngitis, laryngismus stridulus or retro-pharyngeal abscess. In spasmodic laryngitis the first attack is generally the worst, and the dyspnoea is nearly always less severe on subsequent occasions, whereas membranous laryngitis is a progressive affection. In laryngismus stridulus there is a sudden cessation of respiration during the attack, while in the interval there is no cough or hoarseness or any sign of local disease. From true diphtheria the diagnosis can only be made by bacteriological examination, but the onset is usually more sudden, the temperature higher, and the membrane more friable and less white in colour.

Owing to the impossibility, at any rate at once, of excluding diphtheria, the case must be treated with antitoxin, and an emetic dose of ipecacuanha should be given. A steam-tent and a hot fomentation to the throat are advisable, and calomel is much recommended, one to two grains for a child every three hours until the bowels have acted freely, and then three or four times a day together with iron. Calomel fumigations are much used in

America, fifteen grains being volatilized in a closed steam-tent every two hours for two days and then at gradually lengthening intervals. Intubation or tracheotomy may become necessary.

The prognosis is very grave, worse than that of laryngeal diphtheria since the advent of anti-toxin; about half the cases in children terminate fatally.

CHAPTER III

GRANULOMATA

SYPHILIS

Congenital Syphilis usually shows itself in the form of secondary lesions from the fourth to the eighth week after birth ; after the end of the first year the disease is generally quiescent until the time for the appearance of tertiary lesions at the second dentition or at puberty. In severe cases, however, the disease may be apparent at birth ; and sometimes the child seems to have had the secondary stage in utero, for tertiary lesions occur without any secondary manifestations and are occasionally found in the first few years of life, when they may cause stenosis of the glottis. Congenital secondary syphilis in the larynx is associated with the typical skin eruptions and rhinitis, and in the tertiary forms there are usually un-

mistakable signs of the disease, Hutchinson's teeth, signs of interstitial keratitis, and scars at the angles of the mouth. Dysphagia is rare in young children; the common symptom is hoarseness, but stridor and dyspnoea may result in severe cases.

Acquired Syphilis occurs in the larynx in both secondary and tertiary forms; primary chancre is practically unknown. In the larynx especially there is no hard and fast line between secondary and tertiary lesions, and intermediate forms are common; secondary lesions may be found years after infection, and tertiary forms may occur within a few months; the early forms may require the administration of iodides, and deep ulceration is often improved by mercury. The earlier lesions cause but slight symptoms, and are probably often overlooked.

Erythema is an early lesion, and may occur within four to eight weeks after infection. It may resemble simple catarrh, but is more persistent and is usually "patchy" in its distribution; sometimes it affects one cord, leaving the other normal.

Condylomata are sometimes seen; they appear

usually as flat slightly raised grey patches, surrounded by a zone of hyperaemia, and resemble the effect produced by the application of nitrate of silver. The epithelium may be shed and an oval erosion result with a smooth pale base and well-defined edge. These condylomata may affect any part of the larynx; in common with other early lesions, they usually show signs of having spread from the fauces, and thus often attack the edge and lingual surface of the epiglottis. Pl. III, Fig. 2, shows symmetrical erosions on the cords, associated with raucous voice, in a girl who showed no other signs of syphilis; the lesions were rapidly cured by mercury without local treatment. The vocal processes are frequently the site of symmetrical erosions. The macular and papular forms of syphilide occur but rarely in the larynx.

In the secondary forms, the cervical lymphatic glands show the typical indolent swelling.

Infiltration may be, as elsewhere, diffuse or circumscribed. Diffuse infiltration causes tumefaction, and may break down with the formation of superficial ulcers. The entire larynx, or any part

PLATE III.

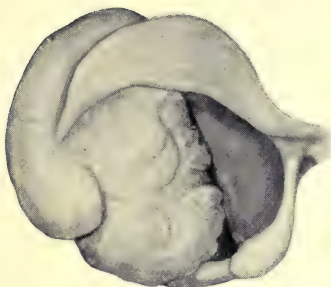


Fig. 1.— Perichondritis of Thyroid Cartilage, with Necrosis.

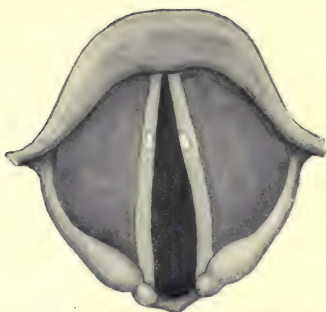


Fig. 2.— Syphilitic Erosions on Cords.

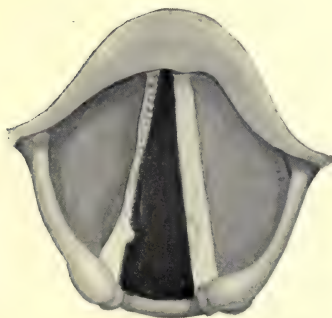


Fig. 3.— Syphilitic Infiltration of Right Cord.



Fig. 4.— Syphilitic Ulcer on Arytenoid.



of it, may be affected ; but on the whole syphilis, in contradistinction to tubercle, attacks the front parts of the larynx, the epiglottis, especially its lingual surface, and the anterior regions of the cords. Thickening is frequent in the anterior commissure, and in severe cases the cords may become adherent, or a web of cicatricial tissue stretch across the glottis, leaving only a gap behind for respiration. Subglottic infiltration is fairly common, and abduction of the cords often limited, so that stenosis at the level of the glottis is much commoner than in tuberculous laryngitis ; the disease may spread far down the trachea. The infiltrated parts are usually dusky red in colour.

Circumscribed infiltration, or *gumma*, attacks usually the arytenoids, lateral wall, or epiglottis, and is generally associated with diffuse infiltration of other parts of the organ. A gumma is nearly always single and unilateral ; it forms a firm, solid, smooth and rounded mass, usually of a deep red colour, and generally breaks down and ulcerates rapidly, but occasionally it appears to undergo a

fibrous transformation, and persists without change over prolonged periods (*see* Plates III and IV).

Ulceration may be superficial or deep; the superficial form resulting from the breaking down of the diffuse infiltration, and the deep from softening of a gumma. The superficial ulcer has a distinct, slightly raised and sharply cut margin surrounded by a definite areola, the base is smooth and flat and the granulations usually small. The deep ulcer is "crateriform," its edge is regular, sharply punched-out and undermined; the base, often covered by irregular necrotic tissue, shows little tendency to granulate; it is thick and firm, being formed by a broken-down gumma, and tends to extend in depth rather than on the surface. As it is formed by softening of the central mass of a gumma, it is deep from the outset. Syphilitic ulcers, on healing, leave a dense scar-tissue, which tends to contract and often produces marked deformity and stenosis. The epiglottis is not uncommonly destroyed by ulceration.

Papillary outgrowths, caused by proliferation of the epithelium, are not uncommon in the posterior

PLATE IV.



Fig. 1.—Syphilitic Infiltration producing Stenosis.



Fig. 2.—Gumma of Arytenoid.



Fig. 3.—Syphilitic Ulceration of Epiglottis.

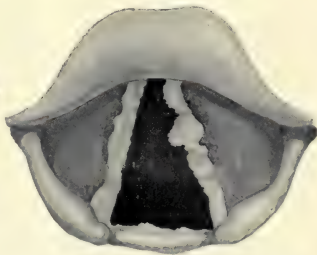


Fig. 4.—Syphilitic Granulations on Cords and Ventricular Bands.



commissure ; they closely resemble those found in tuberculous laryngitis. Sprouting granulations, arising from ulceration, also occur in this region.

Perichondritis occurs in tertiary cases as the result of extension of a gumma, or by the entry of pyogenic organisms in deep ulceration. Rarely the gummatous deposit begins beneath the perichondrium and, no other lesion being present, the disease may appear as a pure perichondritis ; as a rule, however, it is associated with definite syphilitic laryngitis. Any of the cartilages may be attacked separately or together, and the affection may be acute or chronic, suppurative or sclerosing. The sclerosing form is rare ; it is very persistent, and causes much deformity ; usually the swelling breaks down and more or less necrosis of the cartilage results ; the exfoliation of a large sequestrum is extremely tedious and the danger to life, from dyspnoea, dysphagia and septic infection, is considerable.

Subjective Symptoms vary very greatly according to the lesions present.

Hoarseness is common, and is often the only

symptom in the early forms. Very characteristic is the peculiar "raucous" voice of syphilis, in which the vocal effort and waste of air is considerable. Complete aphonia is relatively uncommon; in tuberculous cases one often finds aphonia with but a small cord lesion, whereas in syphilis the power of phonation frequently persists even in advanced cases.

Dyspnoea results from gummatous infiltration and from fixation of the cords, but it is especially apt to occur in the late stages, when contraction has produced stenosis.

Pain is in general less marked than in tuberculosis or cancer, but too much stress must not be laid upon this point, for a gumma of the epiglottis or arytenoid, or perichondritis, may cause the most severe dysphagia.

Diagnosis.—Typical cases are easy to diagnose, but syphilis assumes an extraordinary variety of aspect, and may imitate every form of laryngeal disease. The class of patient, and the absence of all history of infection is, of course, of no importance; there are often, however, especially in the

secondary forms, other signs of the disease about the fauces or on the skin.

From simple laryngitis.—The erythema may be practically identical, but it is usually duskier in tint and often patchy. Redness of *one* cord is never due to catarrh, and neither is definite ulceration. The greyish-white condylomata are pathognomonic, except on the cords where they somewhat resemble the small patches of necrosed epithelium sometimes seen in catarrh (p. 23); the latter are, however, more uniformly regular and symmetrical and are found especially at the junction of the anterior and middle thirds of the glottis. The cervical adenitis of secondary syphilis is an important point of distinction.

From tuberculosis.—Too much stress must not be laid upon the colour; while syphilitic lesions are generally red, they may be pink, and tuberculous infiltration, though often pale, is quite frequently deep red, especially on the epiglottis. Tuberculous infiltration is typically soft and appears œdematous, while syphilis is firm and solid. Syphilis has a predilection for the front parts of the larynx,

tubercle for the posterior region ; tuberculosis seldom attacks the epiglottis until late in the course of the disease, and the ulceration is on the laryngeal surface ; tuberculous infiltration at the upper aperture is smooth, regular and symmetrical, while syphilitic lesions are nodular and productive of puckering and deformity. Tuberculous ulcers are pale and ill-defined ; they have a pale granulating base and are seldom deep except near the vocal processes ; the well-marked edges and dry glazed base of some syphilitic ulcers are very characteristic. Thickening or scarring about the anterior commissure, and contraction producing a slit-like stenosis of the glottis, are highly suggestive of syphilis. (Compare Plates III and IV with Plates V and VI.)

From lupus the diagnosis is generally easy, but a slow serpiginous ulceration of the epiglottis, due to syphilis, may imitate lupus very closely, and the scarring which results from either disease may be quite indistinguishable.

From cancer.—The diagnosis will be more fully discussed in Chapter V. Gummatous ulceration of

the epiglottis or arytenoid may closely imitate extrinsic epithelioma. In general, gummata appear and break down more quickly and are less painful; the edge of an epitheliomatous ulcer is nodular, thick and often everted, while in deep syphilitic ulceration these characters are less marked, the margin is hyperaemic and frequently sharply cut out, and other parts of the larynx or fauces usually show syphilitic lesions. It is sometimes necessary to trust to the results of treatment to confirm the diagnosis; for this purpose potassium iodide must be given in large doses, and it should be remembered that the symptoms of cancer are often temporarily improved by this drug and that syphilitic laryngitis is occasionally very resistant to treatment.

Treatment.—The general treatment is that of syphilis elsewhere; it need only be said here that the iodides do good in some secondary cases and that mercury is generally useful in the treatment of tertiary lesions. The severer forms are accompanied by marked anaemia and loss of health, and here the administration of iron is of great value.

In general, laryngeal gummata yield very slowly to treatment, and these cases are extremely troublesome and tedious. Mercury should be given as well as potassium iodide, the latter in large doses, quickly rising to 30 grains or more three times a day ; these quantities must always be given well diluted in water or milk and never on an empty stomach ; the tendency to iodism may be further diminished by the addition of an equal quantity of sodium bicarbonate. As to mercury, it is most conveniently given by the mouth and the ordinary pharmacopoeial preparations are quite efficient ; a more rapid effect can sometimes be obtained by inunction, a $\frac{1}{2}$ to 1 drachm of mercurial ointment being rubbed into different regions of the skin every day for five to ten minutes, and a warm bath being frequently given ; except when carried out at a spa, such as Aix or Harrogate, it is a dirty and troublesome method. Some cases resist all such treatment, and in these, and when there is dysphagia or dyspnoea, intramuscular injections of mercury are to be recommended. The emulsion of metallic mercury does not act quickly enough for

urgent cases, and I prefer a soluble salt. The injections should be made every other day deeply into the buttock. Sal alembroth, $\frac{1}{5}$ to $\frac{1}{2}$ grain in 10 minims of water, is less painful than corrosive sublimate ; I have found the following preparation efficient and remarkably painless :—

Hydrarg. benzoati	.	.	partem i.
Sodii benzoati	.	.	partes ij.
Sodii chloridi	.	.	partes ijss.
Aquam dest.	.	.	ad partes c.

in doses of 30 to 50 minims or even more.¹

As a rule, specific local treatment is unnecessary ; a mild antiseptic spray or inhalation may be ordered, and careful attention to the mouth and teeth is important. Condylomata are sometimes very persistent ; the careful local application of silver nitrate, solid or in strong solution, tincture of iodine or chromic acid, 5 to 10 grs. to the ounce, will hasten their disappearance. Caustics should not be applied to gummatous lesions ; when the

¹ For intramuscular injections, see *Medical Annual*, 1906 ; *Polyclinic*, November, 1904 ; *British Medical Journal*, November 11, 1905.

ulcers are foul calomel fumigations may be employed, but there appears to be some risk of causing acute inflammation as long as iodine is being excreted by the mucous membrane. The following powder may be insufflated : hydrarg. \bar{c} creta, gr.i, tragacanth gr. ii. Loosened necrosed cartilage should be removed. Stenosis may call for tracheotomy, and subsequent dilatation (*see* Chapter VII) ; but no attempt at dilatation should be made until healing is complete, and for this reason tracheotomy is to be preferred to intubation. The removal of sprouting granulations, etc., with forceps is sometimes indicated to relieve dyspnoea.

CHAPTER IV

GRANULOMATA (*continued*)

TUBERCULOSIS

Aetiology.—According to the source of infection, the cases may be arranged in the following groups :—

1. *Primary Laryngeal Tuberculosis.*—This condition is extremely rare, but does undoubtedly occur. Complete proof of primary disease is difficult, for the laryngeal lesion is apt to assume atypical forms rendering the diagnosis obscure, and it is impossible by clinical examination absolutely to exclude early disease of the lungs ; three cases have, however, been recorded ¹ where a careful post-

¹ Demme, *Zwanzig medizinische Berichte über der Thätigkeit des Kinderspitals im Laufe des Jahres*, 1882. Pogrebinski, referred to by Dr. Wróblewsky, *Medzeyna* (Warsaw), 1887, No. 14. Orth, *Lehrbuch der pathologischen Anatomie*, 1887, vol. i. p. 319.

mortem examination demonstrated the presence of tubercle in the larynx and its absence from the lungs, and there are other cases in which advanced laryngeal lesions were found post mortem with recent infection of the lungs.

2. *Cases secondary to disease above the Larynx.*—These are also rare, and may be included among the primary cases, inasmuch as the lungs are not affected. Lake¹ has seen two cases where the larynx was infected from a tuberculous otitis, and in each instance the lungs became involved considerably later.

3. The larynx may be affected as part of a general *miliary tuberculosis*; the disease is overshadowed by that of other organs, and is of little practical importance.

4. Finally, in the overwhelming majority of cases laryngeal tuberculosis is *secondary to pulmonary phthisis*. Percy Kidd² estimates that 50 per cent. of patients dying of phthisis show lesions of tuberculous laryngitis in the post-mortem room,

¹ *Laryngeal Phthisis*, Lake and Barwell, 2nd edit., p. 4.

² Clifford Allbutt's *System of Medicine*, vol. v.

and that the disease is clinically recognizable in 20 to 25 per cent. of consumptives, excluding the last stage of illness. Of 1,541 consumptives at the Mount Vernon Hospital, where more advanced cases are admitted than is the rule at sanatoria, 13.69 per cent. had tuberculous laryngitis. Though it occurs most often in advanced consumption, it is also found at all stages of the disease and, as it is most amenable to treatment when the phthisis is not advanced, the throats of consumptives should always be examined regularly so that it may be detected at its earliest beginning.

Predisposing Causes.—Tuberculous laryngitis is commoner in males than in females in the proportion of 2.5 to 1. It is most frequent between the ages of twenty and forty, and to a greater extent than can be explained by the age-incidence of phthisis. It is very rare in children; of 605 cases tabulated by Lake and the author it was only found three times up to the age of ten; according to Perrin it is found more often post mortem, for in children symptoms are often lacking and dysphagia is rare.

It is probable that local inflammatory conditions predispose to laryngeal tuberculosis, but, from statistics collected at Mount Vernon, it appears that dusty and sedentary occupations act rather by increasing the liability to consumption than by any direct effect on the larynx itself.

Pathology.—The tubercle bacilli reach the larynx by the blood-stream only in cases of miliary tuberculosis; in all other cases infection is from the surface, through intact epithelium, small erosions and the ducts of glands. The primary deposit is in the mucosa immediately beneath the epithelium and in the submucous layer, and it exhibits its greatest activity around the small blood-vessels and the glandular acini. The pathology is that of the tuberculous process elsewhere, but neither large caseous masses nor calcareous deposits are found in the larynx. The disease spreads by continuity, along the lymphatics and blood-vessels, and by the acinous glands. The spread of ulceration is assisted by a secondary infection with pyogenic cocci, and this is probably an important factor in the causation of deep ulcera-

tion and perichondritis. The cells of the tubercle may become organized, forming scar-tissue, and in this way healing takes place ; the bacilli, however, may remain alive, although encapsuled, and a subsequent lowering of the resistance will then allow the disease to break out afresh.

Ulceration is caused by the breaking down of caseated tubercles, and extends by the further caseation and coalescence of adjacent nodules. At first always superficial, it only slowly extends deeply into the tissues ; this is in contradistinction to tertiary syphilitic ulceration which, resulting from the breaking down of a comparatively large mass of gummatous tissue, is often deep from the outset.

The *lymphatic glands* are rarely involved secondarily to laryngeal tuberculosis, whereas in cases of tuberculous disease of the mouth, pharynx and nose infection of the glands is common.

Michel Dansac ¹ has described in the arytenoid swellings a proliferation of the nerve filaments and

¹ *Annales des Maladies de l'Oreille*, etc., December, 1893, p. 1041.

a neuritis ; this may be the explanation of the severe dysphagia of cases of arytenoid infiltration.

Waxy and fatty degeneration of the muscles have been described ¹ and may cause paresis ; tuberculous infiltration of the muscles is uncommon.

Perichondritis attacks, in order of frequency, the arytenoids, epiglottis, thyroid and cricoid cartilages. The small ulcers often found near the vocal processes are very apt to be followed by arytenoid perichondritis, as the submucous tissue here is scanty. There is generally a pyogenic infection, the perichondrium is loosened and even separated from the cartilage by pus ; necrosis may occur and the cartilage be exfoliated or lie at the bottom of an abscess cavity.

Subjective Symptoms.—The hoarseness of tuberculous laryngitis is of a very characteristic kind ; the voice is weak and but little effort is used in its production, in contradistinction to the raucous voice of syphilis or the so-called “coster’s voice.” Aphonia is common in all stages of the

¹ E. Fraenkel, *Lehrbuch d. pathol. Gewebelehre*, 4th edit., p. 325.

disease and is due to a great variety of causes, such as swelling and ulceration of the cords, interarytenoid infiltration or a granuloma preventing the proper approximation of the cartilages, fixation of the crico-arytenoid joint, and paralysis of the muscles. Functional aphonia is very common, as might be expected in the course of a disease which causes anaemia and debility, and is found in both sexes, though most often in women ; indeed, persistent functional aphonia, associated with debility, should suggest to the practitioner the advisability of a careful examination of the lungs. Cough is usually due to the pulmonary disease, but it may also be caused by the laryngeal lesion, and be amenable to local treatment.

Difficulty in swallowing is of three kinds : painful swallowing, obstruction, and the entrance of food into the larynx. The latter is not common ; it is caused by imperfect closure of the upper aperture from infiltration, rather than by loss of substance from ulceration. True obstructive dysphagia of a high grade is also rare, but painful deglutition, or odynphagia, is unfortunately very common, and

it is this symptom which makes laryngeal tuberculosis such an important and terrible disease. It is found when any part of the upper aperture of the larynx is affected; when the epiglottis is diseased the trouble is chiefly with solid food, but in arytenoid cases it is often most marked when swallowing fluids, for a bolus of soft food partially protects the tender arytenoid. In a disease where ample feeding is so important, even a mild degree of dysphagia is a symptom of the gravest significance. In a later stage, if this symptom is not relieved, swallowing becomes well-nigh impossible, and semi-starvation rapidly brings about a fatal termination.

Dyspnoea due to laryngeal obstruction is a rare symptom; it occurs especially when there is excessive swelling of the arytenoids, and is accompanied by inspiratory stridor.

In addition, a feeling of soreness independent of swallowing, or of dryness in the throat, is often complained of. The laryngeal disease, apart from the condition of the lungs, may undoubtedly cause a rise of temperature.

Objective Symptoms.—The disease affects, in order of frequency, the vocal cords, the arytenoid region, interarytenoid space, ventricular bands and epiglottis. Ulceration is relatively most common on the cords, and after this, in order of frequency, on the ventricular bands, epiglottis and interarytenoid space, and least often in the arytenoid region.

TABLE SHOWING THE LIABILITY TO INFECTION OF
DIFFERENT PARTS OF THE LARYNX.

(From *Laryngeal Phthisis*, Lake and Barwell, 2nd edition.)

	Ary- tenoid.	Inter- ary- tenoid.	Epi- glottis.	Ventri- cular Bands.	True Cords.	Sub- glottic.
Swelling . .	240	218	60	124	159	} 72
Ulceration . .	45	63	50	113	204	
Total . .	285	281	110	237	363	72

Some authorities refer to a “pre-tuberculous stage” of the disease, consisting of anaemia, hyperaemia, or swelling, but without tuberculous

deposit. The use of this term seems to me highly unscientific ; if there is no deposit of tubercle, then these conditions are simply catarrhal, or part of a general anaemia. Unless it can be shown that there is a distinctive laryngeal state which is always, or very often, followed by tuberculosis, but is not yet tuberculous, the expression " pre-tuberculous " should not be employed.

There is a very general opinion that pallor is a characteristic feature of tuberculous laryngitis. This is only partially true ; many consumptives are anaemic, and then the larynx, in common with other mucous membranes, will be anaemic too ; in other cases the colour is normal or reddened from irritation or coughing. Tuberculous granulations are usually pallid, the margins of ulcers are not injected, massive arytenoid infiltrations are often, but by no means always, pale ; but even then the rest of the larynx has no characteristic tint, and very often tuberculous infiltration, especially on the cords, ventricular bands and epiglottis, has a deeply congested red colour.

On the aryteno-epiglottidean folds the infiltration

PLATE V.

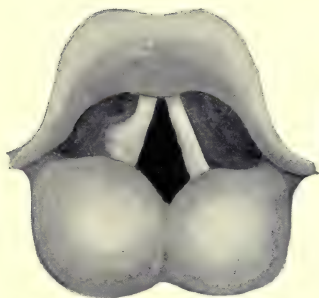


Fig. 1.—Tuberculous Infiltration of Arytenoids.



Fig. 2.—“Turban-shaped” Epiglottis.



Fig. 3.—Interarytenoid Granulations, arising from a Tuberculous Ulcer.

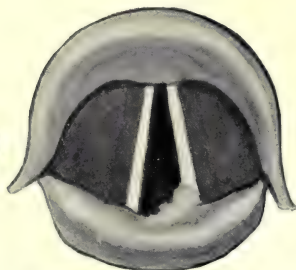


Fig. 4.—Tuberculous Interarytenoid Outgrowth.

reaches its highest grade and may attain an extreme size without ulceration on account of the looseness of the submucous tissue. The infiltration is bilateral, but one side may be more affected than the other. When small the swelling is oval, but when large it assumes the characteristic pyriform or flask-shaped appearance. In colour it may be pale or red, and is often peculiarly translucent; but the swelling is a true infiltration and not due to oedema (*see* Plate V).

The epiglottis is seldom involved until the arytenoids, and indeed the rest of the larynx, are extensively affected. The colour is red, ulceration occurs early and invariably on its laryngeal aspect or on its edge. The swollen epiglottis, together with the infiltrated arytenoids, form a picture which has been likened to a turban, and is absolutely pathognomonic.

The interarytenoid region is often affected and presents a soft, semi-translucent appearance or a peculiar velvety aspect; ulceration and sprouting granulations are common, and firmer warty out-growths are also found.

The ventricular bands may be greatly enlarged by infiltration, but swelling in this situation may also be due to perichondritis of the thyroid cartilage or to infiltration within the ventricle. The disease tends to spread upwards on the lateral wall of the larynx (*see* Plate VII, Fig. 1).

The vocal cords present the greatest variety of lesions which usually, in contradistinction to syphilis, affect their posterior two-thirds. Slight redness and swelling of the cords is, of course, in no way diagnostic, but such an affection of one cord is very suspicious. Swelling of the cords may be slight or quite extreme; in the latter case the cord is rounded and may show a longitudinal groove, due to the impression on it of its fellow. An ulcer is apt to form along this groove, giving rise to the appearance known as "cleft cord." Ulceration of the cords is frequent and occurs early, and the cords may be completely destroyed. In other cases the process is more indurative and they become the seat of a firm pink nodular deposit; or again, the cord may be converted into a broad red band of granulation tissue which adheres somewhat to its

PLATE VI.



Fig. 1.—Tuberculous Ulcer
on Right Cord.



Fig. 2.—Tuberculous Infiltration
of Right Cord.



Fig. 3.—Tuberculous Ulceration
of Cords and Epiglottis.



Fig. 4.—Sessile Papillary
Tuberculomata.

fellow on abduction. The vocal processes are especially liable to slight traumatism, from coughing for example, and for this reason tuberculous ulcers are very common in this situation. In advanced cases they often extend very deeply and expose the cartilage (*see* Plate VI).

Perichondritis of the arytenoids and epiglottis is probably common when these parts are much infiltrated, but has no special clinical manifestations unless suppuration or necrosis occur. Thyroid perichondritis is a rare but important form, and may occur in the absence of any other lesion in the larynx, or indeed in the lungs. The disease may be entirely external, an abscess forming in the neck which may heal under surgical treatment; or the abscess may bulge into the larynx, causing a round unilateral swelling of its lateral wall (*see* p. 48). Cricoid perichondritis is extremely rare.

Tuberculomata are spoken of by some continental authorities as quite common, but in England they are very rare. Sprouting granulations and the ragged edges of ulcers must be kept clearly distinct. Tuberculous tumours show a tendency to occur

when the lung-disease is quite early, sometimes without disease of the lungs, and often without other lesions in the larynx, and they are therefore naturally difficult of diagnosis.

Tracheal ulcers are frequently found post mortem, but are not very often seen clinically ; they cause few symptoms and do not lead to stenosis. Usually they are elongated in shape with their long axes running transversely around the tube.

As the disease may attack any or all of these regions, the clinical picture of tuberculous laryngitis is very variable, but for the sake of clearness three common groups may be described.

1. In the "aryteno-epiglottic" type, the disease principally affects the upper aperture of the larynx, attacking first the arytenoids and spreading slowly to the epiglottis ; while the interior of the larynx may or may not be involved. This form is the most easily recognized and is also the most serious on account of the liability to dysphagia.

2. In the "chorditic" type the vocal cords are the chief seat of the lesions, and the principal symptoms are hoarseness and aphonia ; but the

arytenoids may be affected later and dysphagia ensue.

3. Not uncommonly the interarytenoid space is the only region affected ; there may be hoarseness or no symptoms at all, and the disease is usually very chronic and shows little tendency to get worse or to spread to other parts. This may be called the "interarytenoid" or "pachydermatous" form.

Diagnosis.—It need hardly be said that all laryngeal lesions in consumptives are not tuberculous, though there is a natural tendency to diagnose them as such ; it should be remembered that there is a special tendency among consumptives to catarrhal and pachydermatous forms of laryngitis, and mixed forms of syphilitic and tuberculous disease are not infrequently seen in the same larynx. Nevertheless the physical signs of phthisis are important in the differential diagnosis ; the temperature chart is of value, most cases of tuberculous laryngitis showing an evening rise of temperature ; the sputum should also be examined for bacilli. Stress may be laid on the character of the voice. Microscopical examination of a piece of the tissue

may show tubercles, giant-cells and bacilli ; it must, however, be admitted that in some distinctly tuberculous cases nothing characteristic can be found in the portion removed. A negative result is therefore of no value, and a more certain method is to inoculate a guinea-pig with the material. Koch's tuberculin is doubtless useful in the diagnosis of obscure cases ; a febrile reaction will occur if the patient be tuberculous, and the larynx, if affected, will become more inflamed.

As mentioned above, anaemia of the larynx is no sign of its infection with tubercle. Some forms of the disease are quite distinctive, such as the bilateral pyriform swelling of the arytenoids or the rarer "turban-shaped" epiglottis ; so also sprouting granulations and ulceration in the inter-arytenoid region are almost pathognomonic.

From simple laryngitis.—In the earliest stage laryngeal tuberculosis may exactly resemble catarrh, and in such a case the diagnosis can usually be made only by the subsequent progress ; it therefore behoves us to be guarded in the prognosis of catarrhal laryngitis in consumptives. If one cord

only is affected, the lesion may be due to tubercle, syphilis, cancer or traumatism, but certainly not to catarrh. Tiny superficial erosions are sometimes found in simple laryngitis, but more distinct ulceration does not occur, nor do definite nodules or granulations. Oedematous laryngitis causes swelling of the arytenoids, but the affection is acute and the whole larynx inflamed.

When the interarytenoid region is alone affected the lesions may closely resemble those of the pachydermatous form of chronic laryngitis. Indeed, pachydermia is common in consumptive patients, and Gougenheim believed most cases of pachydermia to be due to tuberculous infection. Pachydermia affects chiefly the cartilaginous glottis; the thickenings are symmetrical and usually leave a depression in the middle line; they are regular in arrangement, smooth or finely crenated, firm and of an opaque white colour, or pink as if composed of thickened mucous membrane. On the other hand, typical tuberculous granulations in this situation are irregular and asymmetrical, soft and semi-translucent, and are often but the edges, or granu-

lating base, of an ulcer seen foreshortened in the mirror.

From syphilis.—The tuberculous ulcer is slow in growth; its edge is extremely ill-defined, has no surrounding zone of injection, and is undermined when the ulcer is deep, but the ulcers tend to spread superficially rather than deeply; the base is set with granulations and often presents a characteristic yellowish, speckled appearance. On healing there is no excessive formation of scar-tissue, and contraction and deformity are of the slightest.

The superficial syphilitic ulcer has a distinct, slightly raised margin, surrounded by a definite zone of hyperaemia, and its base is smooth and flat. The deep ulcer is “crateriform”; the edge is sharply punched-out, injected and undermined; the base, often covered by irregular necrotic tissue, shows little tendency to granulate, it is thick and hard, tends to extend in depth rather than on the surface, and on healing leaves a dense scar which often produces marked deformity.

On the cords, the part affected is of great importance, for it is especially here that the rule applies

that syphilis affects the anterior, and tuberculosis the posterior, parts of the larynx. These points are well shown by comparing Plate VI, Fig. 2 with Plate III, Fig. 3.

The arytenoid region is a common site for the formation of a gumma; but the swelling is unilateral, red and angry, firm and solid, and tends to break down and form a crateriform ulcer.

The epiglottis is seldom attacked by tubercle until a late stage, when other parts of the larynx are affected, and ulceration is always most marked on the laryngeal surface. Syphilis shows a predilection for the epiglottis and, spreading from the fauces, attacks its anterior aspect. Syphilitic lesions often coexist in the mouth or pharynx, where tuberculous ulceration only occurs in the last stage.

From neoplasms.—Only exceptional forms, i.e. tuberculomata, resemble innocent tumours. Papillomata and fibromata hardly ever occur on the posterior third of the vocal cord alone, and are very rarely seen in the interarytenoid space where tuberculous outgrowths are common.

Epithelioma on the epiglottis or arytenoids is red and angry-looking, firm and solid, and ulcerates early ; it is more likely to be mistaken for syphilis than tubercle. Occasionally tuberculosis attacks the vocal cord in elderly persons, and in such cases the diagnosis from epithelioma may be very difficult, especially as there may be little or nothing to suggest pulmonary disease. A dirty-white opaque appearance of the growth is very suggestive of malignancy, as is also delayed or "dragging" movement of the cord. Epithelioma is rare under forty, and seldom occurs on the cords in women.

Treatment.—It must be remembered that, in the great majority of cases, the throat lesion is but a complication of phthisis. The general treatment is not within the scope of this work, but a few points require mention. Except when the larynx is acutely inflamed, open-air treatment is of the greatest value, even when the laryngeal disease is very advanced, and it materially tends to reduce the proportion of cases of laryngeal infection among consumptive patients. A dusty atmosphere is of all things most harmful, and a dry and windy

district is therefore unsuitable; on the other hand, a warm, moist climate seems to be favourable, and even an excessive rainfall harmless.¹ The consensus of opinion, both here and in the Engadine, is that cases with advanced tuberculous laryngitis should not be sent to the high-level resorts of Switzerland. A few early cases become cured spontaneously under general treatment, but such an event is extremely rare; on the other hand, I have seen many improve under local treatment in the most unhygienic surroundings as hospital out-patients.

It is important that the larynx should have very complete rest, and surprisingly good results are sometimes seen if the patient maintains absolute silence for many months; this often has, however, a very depressing effect, and should not be insisted on in those advanced cases where arrest of the disease is out of the question. Severe cough throws a great strain on the larynx, and every attempt should be made to allay it; in bad cases

¹ *Laryngeal Phthisis*, Lake and Barwell, 2nd edition, p. 52.

heroin hydrochloride is of great value for this purpose, given in a linctus containing $\frac{1}{12}$ to $\frac{1}{8}$ grain to the drachm.

When there is any dysphagia an absolutely bland and unirritating diet must be ordered. Semi-solids are usually more readily swallowed than solids or liquids, and milk is often especially difficult. Patients usually find that fluid food can be gulped down when it cannot be sipped; Wolfenden's method is founded on this peculiarity, and is often successful. The patient lies prone on a sofa, with the head beyond the edge, and sucks up the fluid through a tube from a vessel placed slightly below the level of the mouth. Another method, which sometimes gives relief, is for an attendant to make firm pressure with the flat of the hands on either side of the neck during swallowing.

Certain mild methods of local treatment, while not directly curative, are nevertheless of value as palliatives in cases not considered suitable for more active treatment, and also in addition to such measures. Steam inhalations, containing a

sedative such as Friar's balsam, are useful to relieve the dryness and soreness of the throat, and have a good effect on the associated catarrh; but I prefer to order an oily solution in a nebulizer, the fine particles from which pass well down into the respiratory tract, while the oil protects the ulcers and prevents fresh infection. Any of the mild nebulæ given in the Appendix may be used, and menthol seems especially beneficial.

Intratracheal oily injections act in the same way, and I have found them very useful in cases of advanced ulceration, reducing inflammation and relieving discomfort. The temperature of the injection should be between 80° and 90° F., and the amount used about $\frac{1}{2}$ ounce. The syringe must be introduced with the aid of the mirror, and passed below the cords; the injection is made slowly while the patient is instructed to take a slow, deep inspiration and to refrain from coughing for as long as possible. I generally employ a 1 per cent. solution of menthol in liquid paraffin; naphthalene, creolin or guiacol, 2 per cent. of each, may also be used.

For the palliative treatment of dysphagia, the local application of anodynes is essential; of these by far the best for the purpose is orthoform. It is a non-toxic, almost insoluble powder, and is used as an insufflation in doses of 3 to 5 grs.; the anaesthetic effect takes about an hour to develop fully and lasts from twelve to twenty-four hours. It is not an antiseptic, but may be combined with iodoform, amyloform or resorcin. It may be used in an insufflator guided by the mirror, or by the method of auto-insufflation introduced by Leduc. For this purpose I give the patient a straight piece of glass tubing about six inches long; he puts the powder into one end of the tube, introduces the other end well back into the mouth and, by a sharp inspiration, draws the drug into the larynx. Apart from their mental effect, morphine and cocaine produce a marked loss of appetite, the result of which is disastrous to consumptive patients. Therefore they should only be used in the most hopeless and advanced cases, when all other treatment has failed. Morphine is best applied by an insufflator in doses of $\frac{1}{4}$ gr. diluted with 2 grs. of

starch ; cocaine is given as a spray in doses of a few minims of 5 per cent. solution ; they should only be administered by the medical attendant or a well-trained nurse.

Of more truly remedial measures, the application of caustic and antiseptic pigments comes first. A bent cotton-wool mop is employed and the superfluous fluid removed with a sharp flick ; the mop is then introduced under guidance with the mirror, and the pigment thoroughly and firmly rubbed into the affected parts. Cocaine is only occasionally needed for the first few applications when the throat is unduly irritable. Good results can be obtained by weekly applications, but in many cases it is better to make them daily. Of the many drugs employed, lactic acid holds the first place, and I usually employ a mixture, introduced by Lake, containing lactic acid 50 per cent., formalin 7 per cent., and carbolic acid 10 per cent. ; the latter acts as an anodyne, and pain rarely lasts more than a few minutes.

Ulcers, especially on the posterior wall, ventricular bands or epiglottis, may be curetted with

advantage if they do not react to pigments or if the granulations are very prominent. Massive infiltration, such as occurs at the upper aperture of the larynx, is out of reach of treatment by pigments or curette. In such cases removal with punch-forceps is necessary; I prefer Lake's pattern, which is very powerful, and a large forceps made

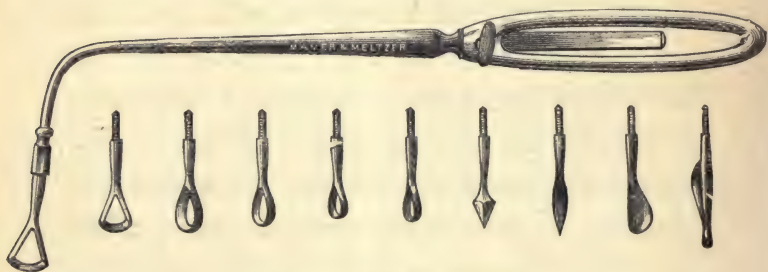


FIG. 7.—Heryng's Curettes.

for my use at Mount Vernon Hospital to remove the infiltrated epiglottis. It is not necessary to excise the entire infiltration as if it were cancer; by this method tension is relieved, the parts are laid open to the action of pigments, and in favourable cases complete healing can be obtained. I do not hesitate, when the pulmonary condition allows, to attack in this way infiltration lying beneath intact

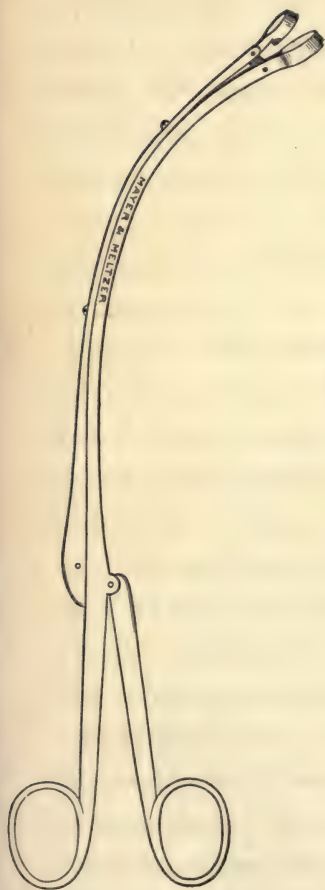


FIG. 8.
Lake's Punch-forceps.

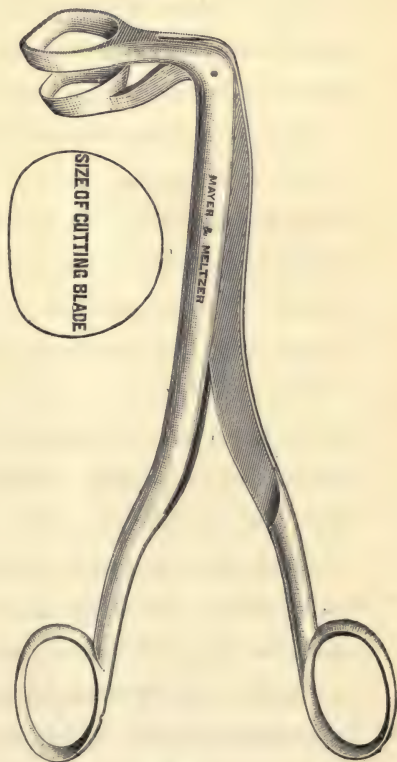


FIG. 9.
Epiglottis Forceps (Author's pattern).

epithelium, for the wounds heal with remarkable rapidity and secondary inflammation is extremely rare. Lake's pigment should always be applied regularly after the operation, except when this is performed only for the relief of dysphagia in a case too advanced for cure.

Of external operations, tracheotomy was at one time recommended to give rest to the parts. It does not do this, but prevents effective coughing, allows secretions to accumulate, and generally does harm. The wound, too, usually becomes tuberculous, and the operation should only be performed for urgent dyspnoea which cannot be relieved by intra-laryngeal methods. Thyrotomy has been performed, especially abroad, on advanced cases, but the results are not encouraging. In my opinion, the operation is only justifiable in those cases where the lung-disease is in an early stage, and the laryngeal lesion inaccessible from the mouth.

Choice of Treatment.—In considering the general principles which should guide us in individual cases, we must remember that the laryngeal disease is a complication of pulmonary phthisis.

It very often occurs in the latest stage of consumption, when any but symptomatic treatment is out of the question. But it is not uncommonly present in quite an early stage of the pulmonary disease, and is quite frequently found in the large class of cases of chronic and partly quiescent phthisis who would otherwise have many years of life before them.

The two most important factors in deciding our line of treatment are the state of the lungs and the laryngeal symptoms, and we may divide the cases into groups according to the results we may reasonably try to obtain.

In the first group come those cases in which the lung-disease is in an early stage and is not progressing rapidly, and even somewhat more advanced cases if they show a tendency to improve ; in fact, all cases in which, from the condition of the lungs, the physician would now give a fairly good prognosis ; the rare cases of primary laryngeal tuberculosis are also included. Of this group of cases it may be said that a cure is always possible, and that the less disease is present in the lungs the

bolder should our treatment be. It must be remembered, however, that when the larynx is affected, the pulmonary signs are often masked to an extraordinary degree; doubtful cases should be observed for a week or so, and the progress of the temperature and weight taken into consideration, before deciding upon active treatment. Usually the laryngeal disease is not extensive in such cases, and can be made to heal by the use of pigments, combined with general treatment; but, if the disease is more advanced or does not respond, little time should be lost before employing the punch-forceps or curette, and it is in these cases that the most brilliant results have been obtained. I would strongly advise against the so-called expectant treatment—that is, no effective local treatment at all—in these cases with early phthisis in the hope of spontaneous cure; for, though it does occur under favourable hygienic conditions, it is really extremely rare. Attempts at curative treatment must be thorough; if such measures are not considered advisable, only sedative and palliative treatment should be employed.

The second group includes those where the lung-disease is so far advanced that a definite cure can not be expected, but without the adverse symptoms of the third group. They are mostly cases of chronic phthisis without high fever or great debility. Here opinions differ widely as to the desirability of active treatment; each case must be judged on its own merits, but in many a local cure can be obtained by active treatment; whereas, as a rule, if the disease be allowed to progress unchecked, severe symptoms will later supervene and the patient die a painful death. For this reason early infiltration at the upper aperture demands surgical treatment, while an outgrowth in the interarytenoid space, which causes no trouble and does not progress, may be left alone.

The third group consists of the hopeless cases, with advanced or rapid lung-disease, rapid loss of weight, hectic fever or severe cachexia, cases of miliary tubercle, and those in which the lung-disease is chronic, though pronounced, if the laryngeal lesions are very extensive. If there are no severe symptoms, only such mild measures as

cause no distress should be adopted; painting with powerful caustics is almost as severe a measure as the use of punch-forceps. When, however, dysphagia is present, active treatment is much more efficacious than any anodyne application. The removal of a small piece from the swollen arytenoid, or the excision of an infiltrated epiglottis, will immediately improve, and often quite abolish, this distressing symptom, while the operation takes but a few moments and is almost painless under cocaine. The palliative effect of surgical treatment in cases of dysphagia deserves more attention than it has received from the profession.

From these considerations, it will appear that when severe symptoms—dysphagia and obstructive dyspnoea—are present, the only contraindication to active treatment is such extreme weakness as to render the patient unable to bear the slight shock of operative measures. On the other hand, when there are no severe symptoms, all energetic treatment is contraindicated if the lung-disease be acute or far advanced. Again, if the lung-disease

be in a curable stage, active treatment must be advised in all cases.

In the large class of cases intermediate between these two groups, there is room for much difference of opinion; in such cases of chronic phthisis the milder laryngeal lesions—infiltration and ulceration of the cords and interarytenoid space—can often be cured by local treatment, and even of the more serious cases of arytenoid infiltration a certain proportion can be soundly healed and many others decidedly benefited.

Although tuberculous laryngitis is found principally in the advanced stage of phthisis, yet it occurs more often at an early stage than is generally believed, and it often causes no symptoms until it is considerably advanced; I therefore most strongly urge that all consumptives should have their larynges inspected at regular intervals and as a matter of routine, so that the condition may be diagnosed while it is most amenable to treatment.

LUPUS

Aetiology.—It occurs by far the most fre-

quently in females and usually shows itself between the ages of twelve and twenty. The affection is undoubtedly due to the tubercle bacillus ; they have been found, though scantily, in the tissues, and their presence is more readily proved by inoculation experiments ; also, the lesions react to injections of tuberculin, and many cases of lupus die eventually of phthisis. But it is still something of a puzzle that, on the skin, pharynx and larynx, the clinical aspect is absolutely different from that of tuberculosis. Perhaps the organism is a variety of the bacillus tuberculosis. Escat has propounded an ingenious theory to the effect that the tubercle bacilli first gain a lodgment on the nasal mucous membrane, where the unfavourable surroundings modify their virulence, and that all cases of lupus, therefore, begin in the nose. It is well known that lupus of the skin usually first attacks the parts around the nose ; the uvula and edge of the palate is a favourite site and, in the larynx, the epiglottis is first affected, as though the disease spread from above downwards. In confirmation of this theory, also, is the fact that only within the nose are lupus

and tuberculosis practically indistinguishable. The interior of the nose is often affected in cases of lupus, but by no means always, though a small lesion, or a healed ulcer, might easily escape detection. The laryngeal affection is usually associated with lesions of the skin or pharynx, but it may also be to all appearance primary. The larynx is attacked in a large proportion of the cases of lupus of the skin, but, owing to its painlessness, the disease often escapes notice.

Subjective Symptoms.—These are very inconspicuous ; pain is slight, or altogether absent, even when there is extensive ulceration. Hoarseness is the principal symptom, but dyspnoea may result in the late stages from contraction of the scar-tissue.

Objective Symptoms.—The lesions begin on the edge of the epiglottis and slowly spread along the aryteno-epiglottic fold, and later affect the bands and cords. There is usually a surrounding zone of localized redness and swelling, and the cords are often reddened, without any definite deposit being visible. The infiltration appears in

the form of small firm nodules of a rosy or deep red colour (*see* Plate VII, Fig. 2), but frequently paler on the epiglottis; these nodules may be absorbed without ulceration, producing a peculiar pitted appearance, or they become soft and "apple-jelly"-like and break down to form ulcers. The ulcers are serpiginous and superficial, with sharply-defined edge and smooth, dry, indolent base; they extend very slowly in some parts and cicatrize in others, forming a large amount of scar-tissue which, in severe cases, contracts and produces great deformity. There is never deep ulceration or perichondritis. The whole process is very slow and insidious, and the only danger to life, except a tendency to phthisis, lies in the results of the secondary stenosis.

Diagnosis.—This is generally easy, especially as the characteristic lesions are usually present on the skin or the palate. Even when the disease is confined to the larynx, the typical form is quite distinctive; it differs from tuberculosis in almost every particular—situation, painlessness, nodular infiltration, and formation of scar-tissue. Syphilis,

however, may imitate it very closely, and in the latest stage, when nothing is left but contracted scar-tissue, the differential diagnosis may be impossible from the appearance alone. In general, syphilitic granulations are larger and project more from the surface, and the ulcers are deeper.

Treatment.—The open-air treatment, as carried out at a sanatorium, has a most beneficial effect on laryngeal lupus. Arsenic is almost a specific for this affection; starting with 3 to 5 minims of the liquor arsenicalis three times a day, the dose is increased by 1 minim every one or two days until 15 minims are taken; this is maintained for a week or so, and then increased as before to 25 minims. If toxic symptoms occur the drug is left off for a while, but can usually be begun again at the same dose. I have more than once admitted cases of somewhat extensive lupus to Mount Vernon with a view to active treatment, and have found the disease improve so much under these general measures that radical procedures have been unnecessary. Injections of tuberculin have also given very good results; the dose should not be large

enough to cause a marked reaction. If the case does not respond to these measures, local treatment should be undertaken on the same lines as that of tuberculous laryngitis. Removal of the affected parts, especially the epiglottis, and subsequent frictions with lactic acid or, better, the mixture of lactic acid, carbolic acid and formalin, may be relied on to give good results. Small isolated nodules are apt to remain after local and general treatment, and by far the best method of destroying these is with the fine point of the electric cautery.

Recurrence is common for a time, and cases should be seen at intervals for a year or two after healing.

The stenosis resulting from the healing of severe cases must be treated on the lines laid down in Chapter VII.

LEPROSY

This disease is so seldom seen in England, that it requires here but a passing mention. It is never primary in the respiratory tract, but the

larynx is very commonly attacked in those suffering from the cutaneous disease. The anaesthetic type is very rare ; the nodular variety is the form found in the larynx. The affection can easily escape attention, for the symptoms are very slight. There is no pain ; the chief symptom is hoarseness and later aphonia, and in advanced cases there may be stenosis and dyspnoea. The nose and palate are attacked first, and the disease spreads to the larynx by continuity, so that the epiglottis is usually the part first affected. At first the infiltration is red and velvety, but later becomes firm, pale and nodular, looking like skin rather than mucous membrane. If the patient live long enough, ulceration will occur, especially in the glottic and subglottic regions, and eventually the cartilages are involved and necrosis takes place. There is marked anaesthesia of the mucous membrane.

The diagnosis is easy from these characteristics, more especially as it is always secondary to the cutaneous disease.

The local treatment is only palliative, and con-

sists in cleansing and antiseptic applications in the stage of ulceration; dyspnoea is rarely so severe as to call for tracheotomy. Internally, chaulmoogra oil, or *oleum gynocardiae*, is generally employed as a specific, and often, it seems, with good results; it is given in capsules in doses of 10 to 30 or more minims three times a day, or, to avoid gastric irritation, by the rectum in daily doses of half an ounce.

SCLEROMA

This affection is indigenous in the south-eastern parts of Europe, and is very rarely seen in this country, and then only in individuals who come from infected areas. It usually begins about the anterior nares and slowly extends to the lip, and backwards to the pharynx and larynx, and therefore it was originally called rhinoscleroma, but it may occur primarily in the larynx. The disease is due to a specific bacillus, and takes the form of a nodular infiltration of almost ivory hardness; ulceration does not occur, but the process is accompanied and followed by the formation of much

fibrous tissue, which contracts and produces marked stenosis.

In the larynx the infiltration chiefly affects the subglottic region and extends down into the trachea, producing stenosis both by the infiltration and by the fibrous contraction. The whole process is extremely chronic, and no treatment has been found to effect a cure. The indication is to treat the stenosis by intubation or bougies, or, if tracheotomy become necessary, to dilate from below (*see* Chapter VII), while parts of the infiltration causing mechanical obstruction may be removed with punch-forceps or cautery. Good results have been reported to follow injections of Fowler's solution, and also from the use of a serum, "rhinosclerine."

CHAPTER V

TUMOURS

INNOCENT TUMOURS

THE common innocent tumours of the laryngeal mucosa form a series, the classification of which is somewhat indeterminate, and our knowledge of their nature and aetiology is not very complete. Some of these growths appear to be definitely due to irritation, especially those occurring at the centre of the vocal cord, and there is no hard and fast line between some forms of inflammatory thickening and a tumour; but neoplasms also occur in very early infancy, and in parts of the larynx where irritation is not likely to act. It is probable that some are produced by micro-organisms, as it is known that the tubercle bacillus may be the cause of a growth clinically indistinguishable from a fibroma or a

papilloma. Growths at the anterior commissure may be due to developmental remnants.

Thus the first change in the formation of a singer's nodule is a thickening of the epithelium, followed by an increase of the subepithelial tissue; spaces filled with fluid soon appear and may be the first stage in the formation of a cyst or of myxomatous degeneration. Again, a papilloma consists of an increase of epithelial cells with a small formation of connective tissue, and cannot be definitely distinguished pathologically from either a singer's nodule or the outgrowths of pachydermia.

Singer's Nodule is described in this chapter for the sake of completeness (*see also* p. 35). The little growths are found chiefly in singers, clergymen, speakers, and teachers, and are apparently due, not so much to overuse of the voice, as to faulty production, especially forcing the voice in the larynx and the use of the "coup de glotte"; dust has also a bad effect, and the chalk from the blackboard is a predisposing cause in teachers. Similar nodules are occasionally found on the

cords of young infants and tend to disappear at puberty. The appearance is that of a minute swelling on the edge of the cord, sometimes on its upper or lower surface; on the opposite cord there may be a depression, or a similar nodule, at the corresponding place, and there is a varying amount of surrounding injection and of general laryngitis (Pl. VII, Fig. 3). The place where the growth occurs, and which is the seat of election for other innocent tumours, is usually described as a point at the junction of the anterior and middle thirds of the vocal cord; it is in reality, however, in the centre of the cord or *pars ligamentosa* of the glottis if the vocal process of the arytenoid be excluded from the measurement. It is here that the maximum vibration, and therefore the greatest irritation, occurs if the cord is swollen or the movements of vocalization faulty, and it is here that a little globule of mucus is likely to form during phonation in cases of laryngitis. This droplet of mucus is, indeed, easily mistaken for a nodule but is distinguished by disappearing after coughing.

PLATE VII.

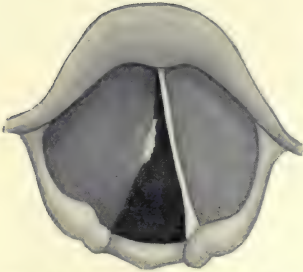


Fig. 1.—Tuberculous Infiltration within the Ventricle.

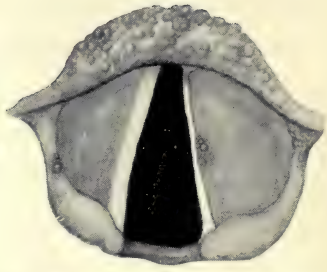


Fig. 2.—Lupus of Larynx.



Fig. 3.—Singer's Nodule.



Fig. 4.—Fibroma.

Fibromata.—The growth known as “simple polypus” usually occurs on the same site as the singer’s nodule of which, as maintained by Chiari, it is simply a further development. They are rounded in form, pink, red, or brown from extravasation, and vary from the size of a nodule to that of a bean or even larger. They are usually vascular and contain comparatively large blood-spaces and also cavities filled with fluid. True fibromata are very rare and may reach a large size; they have been seen on the epiglottis, ary-epiglottic folds, false cords and posterior wall, and also in the trachea.

Papillomata are the commonest tumours of the larynx and occur at all ages; they are frequent in children and appear to be sometimes congenital. When single they generally occupy the “seat of election” on the vocal cord, and are rarely seen on the posterior part of the glottis; but they are often multiple, especially in children, in which case they may occur on any part of the larynx, sometimes filling it with a cauliflower-like mass of growth. They are generally soft and

red in colour, granular or papillary on the surface, and are pedunculated; they do not bleed spontaneously. Rarely one or both cords may be seen to be covered by a horny white papillary growth, described as *pachydermia verrucosa* and due to keratinization of the epithelium; this affection, which may be classified under papilloma or pachydermia, is important in that it may closely simulate epithelioma.

Myxomata occur as smooth rounded growths, usually at the seat of election on the cord; they are pale in colour and translucent and are merely instances of myxomatous degeneration of a simple polypus. Transitional forms, fibromyxomata, may be found. Rarely a large myxomatous growth, filling the larynx, may be encountered.

Cysts of various size occur; the larger ones are found chiefly on the lingual surface of the epiglottis, on its edge, or on the ary-epiglottic folds; sometimes they protrude from the ventricle. They may arise from cystic degeneration of a connective-tissue tumour, from distension

PLATE VIII.

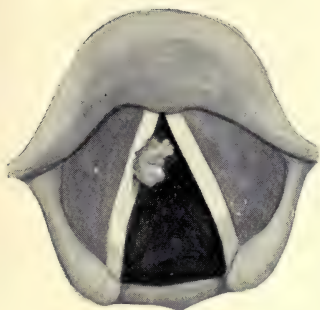


Fig. 1.—Papilloma.

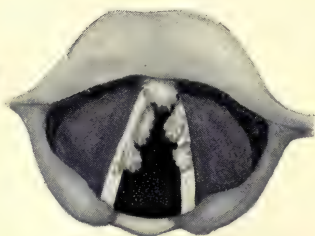


Fig. 2.—Multiple Papillomata.



Fig. 3.—Cyst on Epiglottis.



Fig. 4.—Myxomatous Polypus
of Cord.



of a lymphatic vessel or from obstruction of a mucous gland, but probably the latter are rather cases of cystic adenoma than really due to obstruction. The tiny growths on the middle of a vocal cord are sometimes cystic, and are probably formed in two ways, either from a simple fibrous polypus by enlargement of its serous interspaces, or from one of the mucous glands which are present even on the cords. The larger cysts are smooth, rounded and translucent; the cyst-wall is thin, grey in colour, and often covered by a network of blood-vessels, the contents are clear and serous or colloidal.

Angeiomata are rare, but occur occasionally, either as a flat patch or as a definite purple tumour, on any part of the larynx, including the cords.

Adenomata are almost unknown, unless some of the nodules on the cord be included.

Lipomata have also been recorded.

Chondromata are very rare; they grow from the cricoid, under surface of the epiglottis, thyroïd and arytenoid cartilages. They are firm, sessile and nodular, and tend to grow in to-

wards the lumen of the larynx rather than outwards.

Osteomata do not occur in the larynx. Several cases of multiple osteomata of the trachea have been described; they grow from the tracheal rings and form rounded bosses beneath the mucous membrane.

Accessory Thyroid Glands have been observed in several cases; they occur as bright red sessile tumours in the subglottic region and in the trachea, are only diagnosed by aid of the microscope, and bleed severely if incised.

The *diagnosis* of the common growths is generally easy on inspection; it should be remembered that a tuberculoma may exactly imitate a fibroma and can only be distinguished under the microscope, and that epithelioma may occur at an earlier age than usual; all growths removed from the larynx should therefore be examined histologically as a matter of routine. It has been already said that transitional forms between several of the innocent tumours are found, and it follows that an exact differential diagnosis is

not always possible. The diagnosis from epithelioma is discussed later. Inspection, and therefore diagnosis, is often difficult in young children ; it is, however, nearly always possible by one of the methods already described (p. 9). Escat's epiglottis-tractor is often useful and may be employed, if necessary, under anaesthesia, or Kilian's tube-speculum may be used. A rapid glance will show if the white cords are partly hidden ; and it may be remembered that long continued hoarseness in a child is nearly always due to papilloma, more rarely to a nodule on the cord or to a congenital abnormality.

Symptoms.—Hoarseness results from a growth on the cords or from one so situated as to prevent their free movement or proper approximation ; pain is rare, but a cyst or tumour at the upper aperture may cause discomfort on swallowing. Dyspnoea results when the growths are large enough to block the larynx ; but it is astonishing how slight may be the dyspnoea resulting from a large tumour, provided only that it has grown slowly. Dyspnoea is most frequent and most

serious in cases of multiple papillomata: there is usually spasm of the cords superadded and, indeed, the symptoms may closely resemble those of spasmodic laryngitis.

The *prognosis* as to life is only bad when asphyxia is threatened, especially in children, to whom the long wearing of a tracheotomy tube is a considerable danger. As regards the voice, the outlook is in general good; nodules and growths on the cord may recur and a long period of rest for the voice may be necessary in their treatment; in cases of multiple papillomata in children a guarded prognosis should be given, for frequent removals may leave behind considerable scarring and thickening of the cords.

TREATMENT OF INNOCENT TUMOURS

Tumours which do not interfere with the cords and which cause no symptoms may well be left alone. Growths on the epiglottis can usually be reached by depressing the tongue, others require the laryngeal mirror. The pharynx must be anaesthetized and all the parts which will be

touched, the base of the tongue, the epiglottis, and the neighbourhood of the tumour, must be rendered insensitive with cocaine or alypin applied with a drop-syringe.

Cysts are best treated by making a large hole in the wall with the galvano-cautery or with

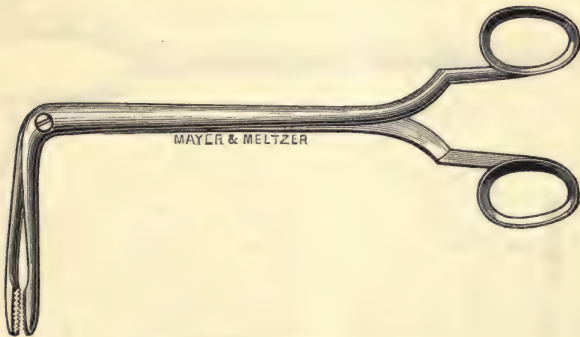


FIG. 10.—Mackenzie's Forceps.

punch-forceps; simple incision is useless. It is wise to leave angiomas alone; if haemorrhage occur the bleeding point should be touched with the galvano-cautery at dull red heat; thyrotomy and removal wide of the growth may be called for by repeated bleeding.

Other tumours must be removed with forceps;

in England Mackenzie's scissor handles are most popular, on the Continent tube-forceps, with the grip like that of a snare, are much employed. Blunt blades are now seldom used; the forceps should have cup-shaped cutting edges to remove

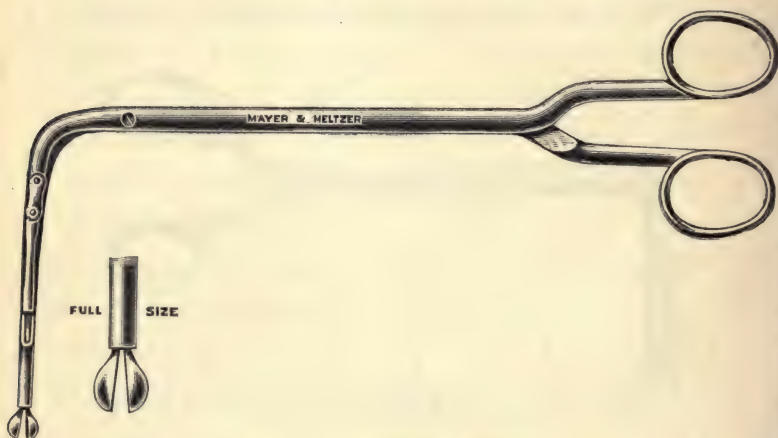


FIG. 11.—Whistler's Forceps.

the growth without tearing it. Many kinds of forceps are in use, and several should be on hand with blades of different lengths from the bend; Mackenzie's pattern is generally useful; for small growths I personally like Whistler's forceps, and Watson Williams has devised an excellent in-

strument with terminals suited to various purposes, while Dundas Grant's pattern may be recommended for growths on the edge of the cord to those who are not fully experienced in laryngeal manipulation. A snare is sometimes employed, especially for growths at the anterior commis-

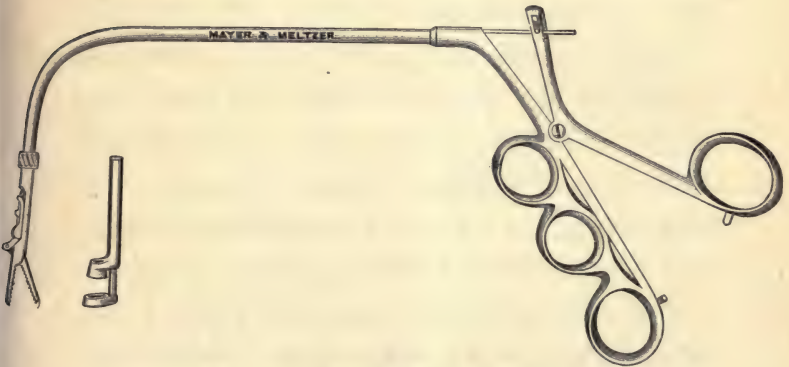


FIG. 12.—Watson Williams' Forceps.

sure ; a warning may be given to employ only the cautery snare for large or possibly tough growths ; it may be used cold, but, if the tissue is very resistant, the wire can be heated ; for great trouble will occur if it is found that the growth, included in the snare, can neither be pulled away nor cut off. Instruments should

always be warmed before introduction, for cocaine does not abolish the sensation of temperature, and they are thus better tolerated. It is sometimes necessary to train the patient, introducing a probe for one or two sittings before using the forceps, and several sittings may be necessary to extirpate multiple tumours.

Singers' nodules and small growths on the cords should be first treated on the lines laid down under *after-treatment*, and will usually diminish or sometimes disappear without operation; an operation on the vocal cord of a professional singer is a serious affair. When removing a singer's nodule care should be taken to excise barely enough to leave the surface flush, otherwise the subsequent scarring may produce a depression. The smaller nodules may be treated by the application of solid silver nitrate fused on a probe, after friction with a roughened probe to remove the epithelium; a very fine galvano-cautery point is even preferable, but less should be done than appears necessary at the time, for the subsequent scarring is considerable.

After-treatment.—The most important point is absolute rest of the voice, which should be continued for two or three weeks, or longer if any thickening remain. Correct vocal production is of great importance, especially for voice users, and Holbrook Curtis' exercises are of much value (p. 44). A simple oily spray in a nebulizer is usually to be ordered, as the patient will attend to these points more thoroughly if local treatment be prescribed. The growth should be completely removed, or recurrence is probable; the stump may be touched with various caustics—silver nitrate, trichloroacetic acid, and chromic acid have been much used; Dundas Grant recommends a solution of salicylic acid in alcohol beginning with 1 per cent., and increasing by 1 per cent. daily to 6 or 8 per cent.; the galvano-cautery is also very valuable.¹

There has been a fear that malignant transformation of innocent growths might result from surgical interference, but this has definitely been

¹ See the discussion at the British Medical Association. *British Medical Journal*, November 5, 1904.

proved to be groundless by Semon's "collective investigation."¹

Papillomata in children may present the greatest difficulty. By far the best way, if possible, is to train the child, spending months if necessary, for then intralaryngeal methods become quite safe, and can be repeated as often as necessary ; this can usually be accomplished with patience in children over 6 or 7. If the child's temper does not allow of this, or if there is dyspnoea, part at least of the growths must be removed more rapidly, and for this the combined chloroform and cocaine method advised by Scanes Spicer answers admirably ; it is not free from danger, and the services of an accomplished anaesthetist must be enlisted, for chloroform must be given to a full degree in the sitting posture ; then the pharynx and larynx are anaesthetized and the cocaine quickly mopped out to prevent it being swallowed ; the mirror is introduced and the growths removed. The operation may last half-an-hour or more ; to prevent secretion of mucus and reflex

¹ *Internat. Centralblatt für Laryngologie*, 1888-89.

swallowing movements the use of cocaine and deep anaesthesia are essential; tracheotomy instruments and a hypodermic injection of strychnine must be at hand, for there is some risk of collapse.

A method of great service, and especially valuable for young children, consists in the use of Killian's speculum under anaesthesia in the recumbent position; straight forceps are used to remove the growths, and the application of cocaine is of great assistance; there is no doubt that cases inoperable by any other method can be treated by this plan. Removal should never be attempted unless a clear view be first obtained, otherwise much damage may be done and complete extirpation is impossible.

If there is marked dyspnoea, tracheotomy should be performed without delay lest spasm ensue suddenly; the growths can be afterwards removed as described above. Tracheotomy has been advised as a method of treatment as tending to produce the disappearance of the tumours; it is very rare that it does so, although it is true that they tend to atrophy at puberty. The long-

continued wearing of a tube is attended by considerable danger, and therefore the growths should always be removed; until lately, however, it was the only method available for young or intractable children.

There has been much discussion as to whether thyrotomy is ever justifiable for innocent growths, and several authorities give an emphatic negative. The operation is now one of little risk to life, the chief objection being the danger to the voice from scar-tissue or imperfect approximation of the cords. In my opinion the operation is on rare occasions quite justifiable and certainly preferable to leaving a cannula in the trachea for a lengthened period; great care must be taken to secure the exact replacement of the two halves of the thyroid cartilage. If the removal of vascular tumours, such as angiomas, becomes necessary, the safest procedure is thyrotomy; chondromata also require external operation.

If obstruction still remains after extirpating papillomata, it is probable that subglottic growths are present; for the treatment of these a high

tracheotomy should be performed and the tumours removed from the wound, and if necessary the cricoid cartilage may be split.

MALIGNANT TUMOURS

Malignant disease in the larynx is nearly always either primary or the result of extension from neighbouring parts; secondary or metastatic growths are practically unknown.

Carcinoma and sarcoma both occur, though the latter is very rare; of epiblastic growths spheroidal-cell carcinoma is met with in both the hard and soft varieties, i.e., as scirrhus or encephaloid cancer, but both are of extreme rarity. The only malignant growth which is at all common is epithelioma, and the following remarks will apply chiefly to this affection.

EPITHELIOMA.

Aetiology.—There is a distinct tendency for the growth to occur on parts subject to slight injury, such as the vocal cords and the posterior surface of the cricoid plate. The disease is rare

below the age of forty, and is commonest between fifty and sixty; it is much more often found in males than in females, and, indeed, intrinsic epithelioma of the larynx is hardly ever seen in women.

Pathology.—The general appearances are those of epithelioma elsewhere; secondary inflammation is common, and in the late stages perichondritis often ensues and necrosis of cartilage may occur.

The *lymphatics* of the larynx are of much importance with reference to the spread of epithelioma; they are numerous, but do not anastomose freely with other systems, and therefore there is little tendency for an epithelioma starting within the cavity of the larynx to spread to other structures or to become disseminated. The lymphatics above the cords empty into two or three trunks in the ary-epiglottic folds which pass through the thyro-hyoid membrane to the glands on the internal jugular vein at the level of the upper border of the thyroid cartilage; a small gland is sometimes present on the thyro-hyoid membrane, but appears to be seldom infected. The lymphatics

below the cords leave the air-tube above and below the cricoid and empty into the lower deep cervical glands along the jugular vein, some pass with the inferior laryngeal vessels to a peri-tracheal chain of glands ; several minute glands may be found on the crico-thyroid membrane and on the trachea, especially about the thyroid isthmus, but are rarely found infected. The vocal cords themselves lie between these two systems ; their lymphatics, which are remarkably small and scanty, pass to the upper set of vessels.¹

The classification of laryngeal cancer by Kris-haber into *intrinsic* and *extrinsic* is very useful and is generally followed. Intrinsic growths are those occurring on the vocal cords, ventricular bands, ventricles, interarytenoid space, and subglottic region, in fact those within the cavity of the larynx ; the extrinsic tumours affect the upper aperture and outer surface of the laryngeal walls, such as the posterior surface of the cricoid. In the later stage a growth may occupy both regions. In-

¹ For a good account with references, see De Santi, *Lancet*, June 18, 1904.

trinsic growths are the commoner; they grow more slowly, glandular infection is late, and they are more easily removed. The prognosis of extrinsic cancer is more unfavourable, for they spread more rapidly, invade the glands comparatively early, and require a more extensive operation.

Symptoms.—Hoarseness occurs very soon on account of the infiltration of the muscles. It of course appears most quickly when the lesion is on the cord and it is associated with the delayed movement so characteristic of epithelioma; but it also occurs comparatively early when other parts of the larynx are affected, as a result of fixation of the arytenoid or infiltration and stiffness of the tissues. The voice has neither the weak aphonic quality of tuberculous laryngitis, nor the rough raucous tone of syphilis, but is usually gruff and low in pitch and may be characteristic enough to arouse suspicion.

There is seldom any pain in the earlier stages of intrinsic growths; but later, and especially in the extrinsic forms, pain may be severe. It is usually

sharp and shoots up to the ear ; it often occurs spontaneously, but is worse on swallowing, and also on coughing and speaking. Obstruction to swallowing is usually a late symptom, but occurs fairly early in cases of tumour on the back of the posterior wall. Obstructive dyspnoea results from blocking of the lumen by the growth, but also occasionally from fixation of the arytenoids or from double abductor paralysis caused by involvement of the nerves or of the crico-arytenoidei postici on the back of the cricoid plate.

Cough is not a marked symptom. Salivation may be present, but usually only in the later stages ; foetor is then common and the patient may die of pneumonia from the inhalation of septic particles. Loss of appetite, failure of health and cachexia frequently appear early, and the general aspect of the patient may aid the diagnosis. Bleeding is common in the late stages, but profuse haemorrhage sometimes occurs quite early.

Objective Appearances.—On the cord, the growth may appear at any part ; but the vocal process, a favourite place for pachydermia and

tuberculous ulceration, is certainly an uncommon site for epithelioma. The disease may assume the greatest variety of forms which, however, tend to conform to the three following types: (1) As a single polypoid growth; (2) as a diffuse infiltration; (3) as a unilateral congestion (*see* Plate IX).

1. In this form the tumour may be white, grey or red, warty or smooth upon the surface and is usually sessile. From the first it grows into and infiltrates the substance of the cord, and so gives rise to the most characteristic signs. Thus, even at the earliest stage, there is a delayed, sluggish movement of the cord; this interference with the mobility, pointed out by Semon, is one of the most important signs of malignancy. An innocent tumour may overlies and conceal its pedicle but, on phonation, it is often distinctly pushed over on the surface of the cord, or, on touching it with a probe or lifting it with forceps, it is movable and pulls up with it a fold of mucous membrane; this is never seen in the case of an epithelioma. Again, there is often some localized tumefaction of the cord beyond the apparent limits of a malignant

PLATE IX.

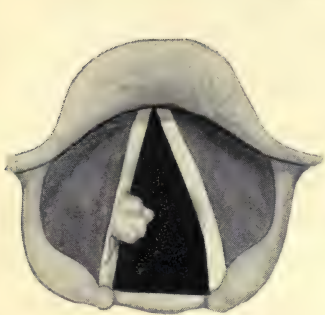


Fig. 1.—Warty Epithelioma.

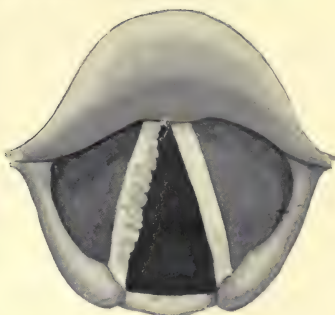


Fig. 2.—Diffuse Papillary Epithelioma.



Fig. 3.—Fusiform Epithelioma.



Fig. 4.—Epithelioma of Epiglottis.

growth ; inflammation of the cord may co-exist with both innocent and malignant growths, but the appearance of enlarged vessels, irrespective of inflammatory redness, coursing over the cord to the tumour, is highly suspicious of malignancy. A tumour growing elsewhere than on the seat of election is also suggestive of epithelioma.

2. In the second type the cord is converted into a mass of nodular or papillary infiltration. The margin sometimes has a peculiar fringe-like appearance ; the infiltration may be deep red, but it often has an opaque dead-white colour which is very characteristic. The nodular variety of tuberculous infiltration may exactly resemble this form of epithelioma, especially when it occurs as senile tubercle in elderly men and, as often happens, is limited to the one cord. There is no doubt that a number of cases of this form of tuberculosis have been diagnosed as epithelioma and treated accordingly ; there is often no suspicion of phthisis and the pulmonary physical signs may be most insidious or may appear to show only a simple bronchitis, while tubercle bacilli may be very scanty. The

movements of the cord are often less impaired in the tuberculous cases, and there may perhaps be slight arytenoid or interarytenoid infiltration to aid the diagnosis. More rarely syphilitic infiltration presents a similar appearance, but the hoarseness is of longer duration, the voice is more raucous, and other parts of the larynx are usually affected; a syphilitic ulcer on the cord has a sharply-cut hyperaemic margin and a smooth shiny base. Some cases of pachydermia, especially the verrucose variety, also resemble epitheliomatous infiltration; they are, however, not often unilateral, and there will be a history of hoarseness of many years duration.

Sometimes the earliest appearance of the growth is as a localized yellowish fusiform swelling with enlarged vessels ramifying upon its surface; combined with impairment of mobility this aspect is very characteristic.

3. Diffuse redness and swelling of the cord is sometimes, though more rarely, the first obvious sign; perhaps the actual growth is out of sight beneath the cord. A similar appearance may be

caused by syphilis or tubercle ; gouty laryngitis occasionally produces a unilateral redness and, rarely, even a diffuse granular infiltration which may closely imitate malignant disease ; the symptoms would usually be more acute, with greater soreness and irritability, and accompanied by congestion of the fauces or pharynx.

These growths spread at first very slowly but later more rapidly and pass beyond the limits of the cords upwards on to the ventricular band and especially backwards to the posterior commissure and so to the other cord. Inoculation of the opposite cord by contact has been recorded.

Elsewhere, as on the ventricular bands, posterior commissure or ary-epiglottic folds, epithelioma usually appears as a red infiltration with an irregular papillary surface. On the epiglottis primary epithelioma is rare ; it usually spreads thither from the pharynx or the tongue. The tumour may originate in the ventricle and, while it is itself invisible, cause swelling of the band indistinguishable from that due to other infiltrations or to perichondritis.

Moritz Schmidt ¹ emphasizes the importance of a rare deep form of growth, which may persist unnoticed for a long time ; it gives rise to papillomata upon the surface which show microscopically no sign of malignancy, because the base is not included in the portion examined ; there is a tendency for perichondritis to occur early, or small whitish knobs may appear between the excrescences and make the diagnosis clear.

Extrinsic growths extend rapidly to the pharynx, and deep ulceration occurs early ; the base is covered with irregular grey sloughing tissue, foetor is generally marked and haemorrhage is common. A favourite site, especially in women, is at the lower end of the pharynx on the back of the cricoid plate. The growth is then frequently out of sight and manifests itself only by causing fixation of the arytenoids or pressure on the recurrent nerves ; some swelling or irregularity of the arytenoid can, however, be often seen, or the growth may be felt with the finger or an oesophageal bougie. The diagnosis of these difficult cases can sometimes be

¹ *Krankheiten der oberen Luftwege*, Aufl. 3, p. 688.

cleared up by direct inspection with Killian's tube-speculum.

Diagnosis.—The lesions which most often imitate intrinsic epithelioma are papilloma, fibroma, and tuberculous and syphilitic infiltration. The chief points of distinction have already been mentioned. Of local signs the most significant are those which indicate the spread of the growth to the deeper tissues, sluggish movement of the cord, immobility of the growth and surrounding tumefaction; the opaque white colour, when present, is also very characteristic. The mistake of overlooking an epithelioma is rarely made, more often simple tumours and infiltrations in elderly people are diagnosed as malignant. In doubtful cases a careful general examination should be made, especially for any sign of syphilis, tuberculosis or even of gout. A portion of the growth should always be removed for examination if there is the least doubt, but the piece should not be very small, and too much reliance must not be placed on the absence of the appearance of malignancy, for the apex of an epitheliomatous outgrowth may resemble

a simple papilloma ; this method is not possible when the growth takes the form of a flat sessile infiltration, and it should only be practised if operative treatment is intended, for injury to the tumour only does harm and may cause rapid dissemination. It must be remembered that pain is not characteristic of epithelioma in its earlier stages.

Extrinsic epithelioma is most likely to be confused with gumma and deep syphilitic ulceration. A gumma grows more quickly and ulcerates more rapidly ; the more infiltration there is around it the more difficult will the diagnosis be ; but the large bosses of new growth, seen on the base and edges of an epitheliomatous ulcer, are never present in syphilitic ulcers, the edge of which is sharper and more injected and the base often covered by a yellow slough. Pain has little diagnostic value, for a gumma on the aperture of the larynx may cause extreme dysphagia. Palpation with the finger is of great service, for the firm hard feel of an epithelioma is very characteristic.

Treatment.—Malignant disease cannot be re-

moved with certainty by the natural passages, and the attempt should never be made. Thyrotomy is generally performed in this country for intrinsic growths, provided that they are seen in an early stage ; the results are very good as regards recurrence, the mortality is low, and a fairly good voice usually remains. The tissues must be removed wide of the growth and the soft parts should generally be stripped off the cartilage by raising the perichondrium. If the infiltration has reached the opposite cord, both sides may be treated in the same way, and parts of the arytenoid may be clipped away if necessary ; but if the growth has spread far on to the posterior wall or involved the thyroid cartilage, a more extensive operation is called for. Excision of one-half of the larynx usually leaves an audible voice, but the mortality is high on account of the impossibility of shutting off the pharynx ; when the disease is too extensive for thyrotomy, it is far safer to perform complete laryngectomy. Where the growth has extended far on to the pharynx or far down the trachea, or where the glands are extensively affected, operation

is in general contraindicated ; Glück¹ has performed very extensive excisions of the larynx and pharynx with a wonderfully low immediate mortality.

The management of inoperable cases is both difficult and trying, but with care much may be done for the comfort of the unfortunate patient. Strong irritating solutions should not be used, but the parts can be kept clean and foetor controlled by frequent spraying with such antiseptics as permanganate of potash, listerine or lysoform ; I consider resorcin very useful, in solutions of 1 to 2 per cent. or as a powder. The pain generally defies our efforts at last ; orthoform is the most valuable anodyne and should always be employed first either alone or with resorcin, iodol or amyloform, as an insufflation (*see Appendix*). Cocaine loses its effect too soon to be of much use, it should at least be kept in reserve till the last stages ; morphine has to a less extent the same disadvantage, it is best used locally in powder form (*see Appendix*) ; late in the case a hypodermic injection may be necessary half-an-hour before meals. In certain cases local

¹ *Monatschrift für Ohrenheilkunde*, 3 and 4, 1904.

surgical treatment will give great relief ; thus the rapid removal with punch-forceps of an ulcerated epiglottis may restore the patient to comparative comfort ; so also the incision of a perichondritic swelling, or curetting an epitheliomatous ulcer, will have a good effect in suitable cases.

Dyspnoea usually calls for tracheotomy, which should not be too long delayed. The growth may cause much trouble by extending to the wound and down the trachea ; longer and longer tubes are necessary, until the disease reaches the bifurcation. Occasionally removal of portions of the growth *per vias naturales* may be employed to obviate the necessity of tracheotomy. Schmidt puts the average duration of life after tracheotomy at seventeen months.

Prognosis.—Although the prognosis of epithelioma is always serious, it is better for intrinsic growths of the larynx than for those of, perhaps, any other region, and this for several reasons. Thus the spread is slow at first, extension along the lymphatics is late in occurring and dissemination is rare ; but the most favourable point is that very

early diagnosis is possible, because hoarseness is present at the earliest onset and because the region is within easy reach of inspection. The moral of this is that hoarseness in a man over forty, persisting in spite of treatment, should always receive attention ; and that such a case should always be examined with the laryngoscope.

SARCOMA

This is a very rare affection ; it may occur in any form, but the spindle-cell tumour is the most common. It is two or three times as frequent in men as in women and is chiefly found above the age of forty. Sarcomata are generally intrinsic and usually appear as rounded mammillated tumours, bright in colour, either red or yellow, and rapid in growth. They have been observed fairly often in the trachea. The diagnosis is seldom made at the first inspection ; they imitate other forms of tumour and also, on account of their rounded shape, may closely resemble perichondritis. The treatment should be on the same lines as that of epithelioma, and there is said to be less liability to recurrence after operation.

CHAPTER VI

NEUROSES

MOTOR NEUROSES

ORGANIC PARALYSIS

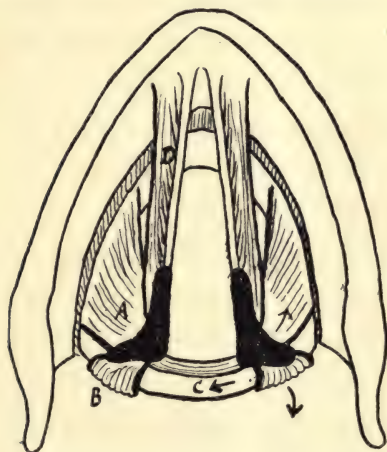
LARYNGEAL paralysis is a frequent symptom of disease of distant organs, and the laryngoscope is therefore an instrument of great value to the physician as an aid to diagnosis. More especially is this the case in that many of these laryngeal palsies give rise to no symptoms whatever, and cannot be diagnosed or even suspected without laryngoscopic examination. I lay stress upon this because it is often thought that if the patient is not hoarse, if he can speak or even sing normally, there can be no paralysis ; but this is by no means the case, for in the common form, abductor paralysis, there need be no disturbance of vocalization.

The *superior laryngeal nerves* are the sensory nerves of the larynx but supply also one pair of muscles,

the crico-thyroidei. Owing to the short course of these nerves isolated paralysis of the crico-thyroid is very rare but results occasionally from section of the nerve, especially in suicidal wounds, and from pressure on it by tumours and enlarged glands. Lesions of the vagus above the origin of this branch will also paralyse the crico-thyroid, but the palsy the signs of which are not well-marked, will be obscured by that of the other muscles of the cord. The action of the muscle is to make the cord tense, and when it is paralysed the affected cord remains slack on phonation and flaps up and down with respiration. The voice is not lost, but is weak and easily tired.

The other muscles are all supplied by the *recurrent laryngeal nerve*, and act in the following way. The vocal cords are fixed in front to the thyroid cartilage, but behind they are attached to the mobile arytenoid cartilages, which are free to rotate on a vertical axis and also to glide inwards and outwards along a nearly horizontal plane. One pair of muscles, the crico-arytenoidei postici, act as abductors of the cords ; each rotates the vocal process of

its arytenoid outwards, and also causes a gliding movement of the whole cartilage outwards and backwards. Of adductors there are two pairs and one unpaired muscle ; the crico-arytenoidei laterales



- A. Crico-arytenoideus lateralis.
- B. Crico-arytenoideus posticus.
- C. Arytenoideus.
- D. Thyro-arytenoideus.

FIG. 13.—Schema illustrating the action of the muscles of the cords.

rotate the vocal processes inwards ; the arytenoideus draws the cartilages together, while the thyro-arytenoidei make tense and straight the edges of the vocal cords. All these muscles may be para-

lysed separately or together, and very diverse laryngeal appearances and symptoms are the result.

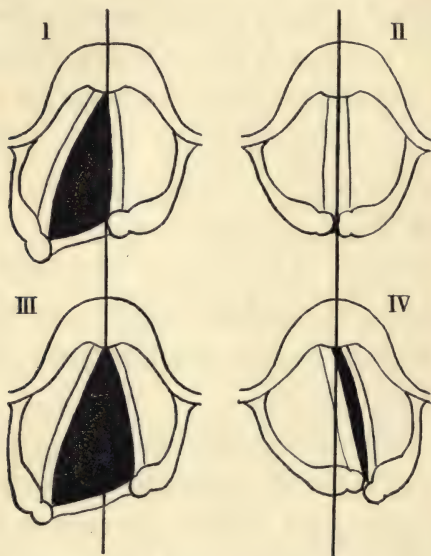
In a healthy larynx the edges of the cords on phonation are straight, parallel and almost in contact ; on deep inspiration the cords are widely abducted. During quiet breathing there is but little movement ; in the " position of rest " the width of the glottis is fairly constant and is maintained by a tonic action of the abductors, for it is distinctly wider than that of the " cadaveric position " assumed after death or in complete paralysis. In any gradually progressive lesion of the nerve-path, the muscles become paralysed in a certain definite order, the enunciation of which is known as Semon's law. The abductor fails first and may be for an indefinite time the only muscle affected ; then the thyro-arytenoideus becomes paralysed, and finally the crico-arytenoideus lateralis. The arytenoideus has a bilateral nerve-supply and is not affected in unilateral cases.

This peculiar sequence of events is constant and is due to a greater vulnerability of the abductor muscle, comparable to that of the extensors of the

limbs which are the more readily affected in such lesions as neuritis or infantile paralysis. It has been suggested that the median position, which the cord at first assumes, is due to spasm, the powerful adductors overcoming the weaker abductor muscle ; but it is improbable that spasmodic contraction could hold the cord in this position for years, and Semon and others have shown that the abductors are less resistant and lose their irritability sooner than the adductors, and post mortem the abductor muscle is found to be early and extensively atrophied in these cases.

When **abductor paralysis** has occurred the affected cord lies in the middle line ; during phonation the sound cord adducts to meet it and the larynx appears normal. But on inspiration the paralysed arytenoid remains in the same position, while the sound one is drawn outwards and backwards behind the level of its fellow, making the paralysed cord appear the shorter. In this position the sound cord lies also at a slightly lower level because the crico-arytenoid joint is placed obliquely with its outer end lower than the inner.

There is no alteration in the voice. As the maximum available aperture is reduced by half,



- I. Left abductor paralysis : inspiration.
- II. Left abductor paralysis : phonation.
- III. Left total recurrent paralysis : inspiration.
- IV. Left total recurrent paralysis : phonation.

FIG. 14.—Paralyses of the recurrent laryngeal nerve.
(From the *Lancet*, June 3, 1905.)

there will be some dyspnoea on active exertion, but in adults there is no obstruction to quiet breathing. Owing to the small size of the glottis in children

unilateral abductor paralysis does cause dyspnoea, which may occasionally be so severe as to necessitate tracheotomy.

In cases of **bilateral abductor paralysis** both cords lie together near the middle line. When paralysis is complete they do not abduct at all on inspiration but, on the contrary, are drawn closer together ; this is due to the shape of the cords, the sharp edges of which look upwards and inwards and act under the downward rush of air somewhat like the cusps of the aortic valves. In consequence, dyspnoea is a marked symptom, it is inspiratory and accompanied by stridor ; severe paroxysmal exacerbations are prone to occur not only on the slightest exertion but also during sleep, and these may at any time prove fatal. For this reason it is advisable in all such cases to perform tracheotomy as a precautionary measure ; a plug may be worn in the tube, but it can be quickly taken out when dyspnoea becomes urgent, and should always be removed at night. Phonation is quite good, but the difficulty in taking a full inspiration gives to the speech a peculiar breathless character.

When the thyro-arytenoideus muscle fails the edge of the cord is no longer straight on phonation but forms a concave line, the cartilaginous glottis being still well closed. The cord appears narrower and more rounded, at first because it retracts behind the ventricular band, and later from atrophy of the muscle. The voice now becomes gradually hoarse.

Finally, when **total recurrent paralysis** has occurred, the cord assumes a position midway between the middle line and the normal position of rest; this is called the "cadaveric position." During inspiration the sound arytenoid lies abducted and behind its fellow; on phonation it moves across the middle line and pushes the paralysed cartilage aside and usually backwards, probably because the structures of the affected cord are rendered slack by atrophy; the sound cord also lies at a slightly higher level than the paralysed one on phonation. The paralysed arytenoid sometimes drops forwards, exposing its broad posterior surface to view; the peculiar appearance which results may easily be mistaken by the inexperienced for an

infiltration or a tumour. As the cords are still able to meet, the voice is not lost, but it is hoarse and readily tired ; it sometimes has a peculiar “diphonic” or double tone, due to the unequal tension of the two cords, or a rattling quality from the coarse vibrations of the slack cord.

In cases of **bilateral recurrent paralysis**, the severe dyspnoea present in the stage of double abductor paralysis passes off, and the voice is completely lost. Both cords lie in the cadaveric position, but sometimes even now a slight inward movement may be seen on attempted phonation, owing to the action of a partially active arytenoideus muscle ; it has been conjectured that this muscle may at times receive part of its supply from the superior laryngeal nerve.

The *diagnosis* of these paralyses is usually easy ; even when the patient is very intolerant and only a fleeting glimpse of the posterior part of the larynx can at first be obtained, the view of one arytenoid lying asymmetrically behind the other is highly suggestive. Confusion may be caused by obliquity of the image due to a crooked position of the mirror ;

even then the movements of the cords are equal, and the difficulty vanishes on placing the mirror correctly or introducing it with the other hand. In nervous people the cords are sometimes imperfectly separated, or even adducted, on inspiration and may thus give the appearance of double abductor paralysis; if the patient be directed to phonate as long as possible, the cords will abduct naturally during the involuntary inspiration which follows. Fixation of the arytenoid cartilage occurs, sometimes from disease of the joint, but more often from adhesions around it; the cartilage is usually fixed near the cadaveric position, so that the diagnosis has to be made, not so much from abductor, as from total recurrent paralysis. The distinction is seldom difficult, for fixation is nearly always accompanied by scars, swelling or deformity; when this is not the case the diagnosis can be made by observing that the arytenoid is quite motionless and is not pushed away by its fellow nor twitched inwards by the arytenoideus, on phonation. Nevertheless the diagnosis is not always possible, and in old-standing cases of paralysis some fixation often

results and the voice becomes stronger in consequence.

AETIOLOGY

The larynx is an organ which has two functions, more or less antagonistic, that of phonation and that of respiration; the adductor muscles subserve the former, and the abductors the latter function. Of the two, phonation is the more recently acquired and, being directly controlled by the will, has a well-marked cortical centre situated bilaterally in the lower part of the ascending frontal convolution; stimulation of either phonatory centre causes adduction of both vocal cords. On the other hand, the respiratory function is older, more vital and less under conscious control; it can be maintained, in dogs, by the bulbar centres after ablation of both cerebral hemispheres, and its cortical centre is less well defined. In accordance with this, functional disturbances always produce paralysis of the adductor, while organic lesions paralyse the abductor muscles first. From this it appears that no unilateral lesion above the bulbar nuclei

can paralyse the cords, for they are controlled from both cerebral hemispheres ; and that if both tracts from the cortex be destroyed the resulting paralysis must affect both cords and be adductor in type, as in a case reported by Eisenlohr. And this is in accordance with clinical experience, for in cases of hemiplegia, even with aphasia, the larynx is not paralysed any more than are the muscles of respiration.

From the bulbar nucleus the nerve fibres pass in the roots of the bulbar-accessory to the vagus and thence to the recurrent laryngeal nerve ; the lesion causing paralysis may, therefore, be situated (1) in the medulla, (2) at the base of the brain, (3) in the vagus, or (4) in the recurrent laryngeal nerve. The cause is often hard to find and, indeed, frequently remains undiscovered.

In cases of paralysis from bulbar diseases and from lesions at the base of the brain neighbouring nuclei are liable to be affected as well ; paralysis of one cord and of the same side of the palate is an important symptom-complex and points to nuclear disease ; a few rare cases have been recorded of

paralysis of cord, palate, sterno-mastoid and trapezius from involvement of the bulbar and spinal-accessory roots. Persistent frequency of the pulse, due to disease of the cardio-inhibitory centre, is an important sign of nuclear disease. Paralysis of bulbar origin are frequently, but by no means always, bilateral. *Tabes dorsalis* is the most frequent cause of paralysis of bulbar origin and is so common that it should always be thought of in cases of palsy of uncertain causation. Though usually associated with other better known symptoms, it may be for years the only discoverable lesion; Lermoyez ¹ states that 34 out of 100 tabetics had laryngeal troubles. The paralysis may affect one or both cords. Other laryngeal neuroses occur in *tabes*, anaesthesia, paraesthesia and the so-called "laryngeal crises," which will be described with the spasmodic affections. In general paralysis abductor palsy is not uncommon; Permewan ² observed it seven times in thirty-four cases. Syphilitic nuclear disease, gummata at the base of the brain and

¹ *Semaine médicale*, 1897, p. 167.

² *British Medical Journal*, November 24, 1894.

syphilitic pachymeningitis are fruitful causes of laryngeal palsy ; the ocular muscles, especially the external rectus, are often affected as well. In bulbar paralysis laryngeal palsy is the rule ; it is nearly always bilateral but rarely appears until late in the disease, when the tongue is atrophied and the palate and pharynx are paretic. Syringomyelia and amyotrophic lateral sclerosis are rarer causes ; disseminated sclerosis seldom produces paralysis, but the intention tremors can sometimes be well seen in the larynx.

Of peripheral causes, neuritis is probably a more frequent factor than was until lately realized. Several forms may be distinguished : toxic, due usually to lead, rarely to alcohol and arsenic ; and infective, chiefly caused by diphtheria, less often by typhoid, influenza and other fevers ; in these cases other typical lesions will usually coexist. Some cases of paralysis occurring in the course of tuberculosis or syphilis may be explained by a neuritis. In addition there are cases of so-called primary neuritis analogous to Bell's facial palsy where the affection is transient and the only cause

appears to be "cold." Here also one may mention those cases where the posticus muscle seems to have been directly injured by the passage of a large or hard body down the oesophagus, and those in which its fibres are destroyed by cancerous or other infiltration.

In lesions of the vagus above the origin of the superior laryngeal nerve involvement of the afferent nerves causes anaesthesia and sometimes reflex bilateral spasm. Peripheral lesions, however, usually affect the vagus below this level or, more often, the recurrent laryngeal nerve. Traumatism is a rare cause, usually resulting from surgical operations, especially on the thyroid gland and oesophagus; the cord, of course, at once assumes the cadaveric position. Paralysis is usually due to compression of the nerve and the most frequent causes of this are, in order, (1) aneurysm, (2) enlarged glands, usually tuberculous, sometimes syphilitic or malignant, and (3) cancer of the oesophagus. Rarer causes are mediastinal growths, pulmonary tubercle, goître, cancer of the lung, pleurisy, and massive pericardial effusion. The resulting paraly-

sis is seldom bilateral ; oesophageal cancer and goître are the commonest peripheral causes of bilateral paralysis.

Of all causes of laryngeal palsy aneurysm is the most frequent. Owing to the course of the left recurrent nerve the left cord is most often affected, but an aneurysm of the innominate may compress the right cord and bilateral paralysis has resulted from a very large aortic aneurysm and from the simultaneous presence of two aneurysms. In addition the pressure of an aneurysm may cause glottic spasm by irritation of the vagus or trachea, and also the peculiar "brassy" cough which becomes "wheezy" when there is complete paralysis of a cord ; and finally dyspnoea may result from pressure of the aneurysm on the trachea or main bronchus. In a doubtful case of thoracic tumour I believe that paralysis of the left cord points to aneurysm rather than to mediastinal new growth. This paralysis of the left vocal cord is often the earliest, and for some time the only, sign of thoracic aneurysm ; for this reason the prognosis should be guarded in cases of paralysis of unknown origin ; on the other

hand, paralysis of one cord is not dangerous in itself and may be due to some unimportant cause, such as an enlarged bronchial gland. A skiagram will sometimes reveal an aneurysm long before it can be detected by physical signs.

Tuberculosis is a fairly frequent cause of cord paralysis, either by pressure of diseased bronchial or tracheal glands, when the left cord is generally affected, or by involvement of the nerve in a tuberculous infiltration at the apex of the lung; the right recurrent nerve lies close to the pleura and is the most often affected in this way, so much so that unilateral paralysis of the right cord should always suggest a suspicion of phthisis. The association of laryngeal palsy with a thyroid tumour, though suspicious, is by no means conclusive of malignancy, for an innocent goître may compress the nerve, especially if growing rapidly or becoming inflamed, or if haemorrhage occur into a cyst.

Treatment.—The majority of cases are incurable; if, however, the paralysis is due to neuritis or to syphilis appropriate general treatment must be ordered together with the persevering use of fara-

dism to the affected muscles, applied with an intralaryngeal terminal under guidance with the laryngoscope. Strychnine is of value and should be given in large doses, beginning with five minims of liquor strychninae three times a day after meals, and increasing the dose slowly to ten or more minims. When the cause is peripheral and incurable no local treatment is advisable. After removal of the compressing agent, such as enlarged glands or thyroid tumour, the muscles may slowly recover and treatment by faradism and strychnine should be employed. Cases of bilateral abductor paralysis must be tracheotomized lest a sudden attack of dyspnoea prove fatal.

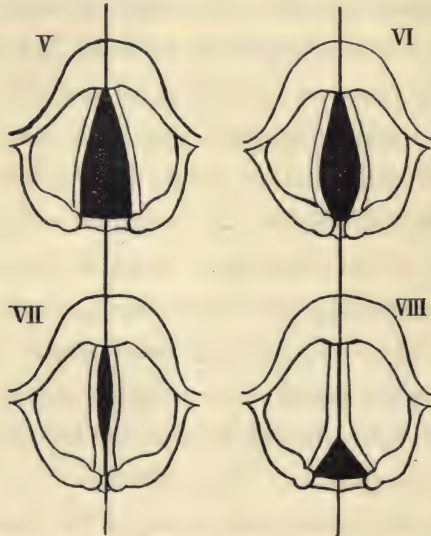
FUNCTIONAL PARALYSIS

Paralysis of the phonatory function, or adductor paralysis, forms a totally distinct class. It is never caused by organic disease of the nerve path from the bulbar nuclei downwards, but is due either to a neurosis or to local disease, infiltration or degeneration, directly interfering with the action of the muscles. The latter, the so-called myopathic

paralyses, are very frequent in a slight degree in all forms of laryngitis.

Functional aphonia, the result of a neurosis, is a common manifestation of hysteria, but it should be clearly borne in mind that the majority of cases are not purely hysterical. Anything which makes the effort of phonation greater than usual, such as constitutional debility or laryngeal catarrh, predisposes to this affection, which is characteristic rather of debility than of hysteria; and this explains how some patients with slight laryngitis have complete loss of voice, whilst others can phonate well although suffering from a much more marked local inflammation. The affection is especially common in consumptives owing to the combination of debility with a tendency to laryngitis, and it occurs in men as well as in women, though much less frequently. In purely hysterical cases the cough is usually not aphonic; the onset is sudden, as also is the recovery, for many patients regain the use of the voice, as it were miraculously, on the application of the faradic current or a strong astringent. In the most marked hysterical cases

there may be also inability to whisper, "hysterical mutism"; sometimes this exists when ordinary



- V. Paresis of all the adductors : phonation.
- VI. Arytenoideus unaffected : phonation.
- VII. Paresis of the thyro-arytenoideus : phonation.
- VIII. Paralysis of the arytenoideus : phonation.

FIG. 15.—Functional paralyses.
(From the *Lancet*, June 3, 1905.)

phonation is normal, a condition which has been termed "apsythyria."

The paralysis is practically always bilateral and is very seldom complete, usually amounting only

to an imperfect apposition of the cords. There are three sets of adductor muscles, the crico-arytenoidei laterales, the thyro-arytenoidei and the arytenoideus (*see* p. 147) ; they may all be affected together, the arytenoideus may escape, or the thyro-arytenoidei may be alone affected. The arytenoideus may, though rarely, be paralysed alone ; it gives rise to a very peculiar appearance, a triangular chink being left at the posterior part of the glottis (Fig. 15).

Diagnosis.—Adductor paralysis may be mistaken for bilateral total recurrent paralysis, for in neither affection do the cords come together on phonation, but in incomplete adductor paralysis they separate widely on deep inspiration ; cases of complete adductor paralysis will cause no difficulty, for the cords are in the position of extreme abduction.

Treatment.—Local stimulation of the larynx will usually restore the voice for a time. Faradization is the best method, one electrode being passed into the larynx, while the other is applied to the neck ; the current should be slightly painful. The application of chemical stimulants on a cotton-wool mop

often has the same effect ; chloride of zinc, 20 to 30 grains to the ounce, and the liquor ferri perchloridi B.P., are among the most useful. Relapse is common but, in favourable cases, each repetition of the treatment brings back the voice for a longer period. Attention should be paid to voice-production and particularly to the action of the respiratory muscles ; most of these patients try to phonate with the chest emptied of air, they should be instructed to take a deep inspiration and to speak with the chest well expanded. Simple vocal exercises (p. 44) often do good. Catarrhal laryngitis must be appropriately treated, and any predisposing causes, such as pharyngitis or marked nasal obstruction should receive attention. The general health must be considered ; iron, arsenic, and especially strychnine are of value, and for hysterical cases valerian may be prescribed ; large doses of the latter are necessary, 1 drachm of the ammoniated tincture, or valerianate of zinc in a 5-grain pill, three times a day. For severe hysterical cases the Weir-Mitchell treatment is indicated, consisting of isolation, rest, massage and plentiful

nourishment. Functional aphonia in consumptive patients is especially intractable; the treatment of the constitutional disease is the important indication, and the voice will generally return as the phthisis improves. Persistent functional aphonia should always suggest the possibility of phthisis.

SPASMODIC AFFECTIONS

Glottic spasm produces adduction of the cords; for, though the abductors are probably affected at the same time, they are overpowered by the stronger adductor muscles. Irritation of the centripetal fibres of the vagus of one side causes reflex spasm of both cords; although experimentally stimulation of the peripheral end of a divided recurrent laryngeal nerve produces unilateral spasm of the same cord, this does not commonly occur clinically, and glottic spasm is practically always bilateral.

The *causes* of spasm may be (1) peripheral, (2) central organic, or (3) central functional disturbances. The peripheral causes are usually local disease, inflammation, tumours or foreign bodies in

or near the larynx; but spasm may be also caused by irritation of the nerves by an aneurysm or other growth; children are much more liable than adults to spasm as a result of local irritation or inflammation. Examples of central organic causes are tabes dorsalis, general paralysis, and hydrophobia. Spasms due to functional disturbances are common; they occur in men as well as in women, and are associated with hysteria and neurasthenia. They may be excited by sexual disturbances; Störk mentions a case where an impotent man and his wife both suffered from laryngeal spasm. Later he found the wife cured and the mother of three children; she had found help elsewhere.

Symptoms.—The attack usually begins with a tickling sensation in the throat and a series of short coughs; then the glottis closes tightly and the cords may even overlap; violent but ineffectual inspiratory efforts are made, there is often loud stridor, but, in the worst cases, when the glottis is completely closed, there is of course no sound. The patient clutches at himself or at chair or table and is overwhelmed by a horrible anxiety; as the

spasm relaxes the air enters with a loud crowing inspiration and breathing then becomes normal. There may be marked cyanosis, and in severe cases there is loss of consciousness from asphyxia or from embarrassment of the heart. In such cases the spasm then relaxes, and in consequence a fatal result is very rare, except when a foreign body, laryngeal tumour or other cause of obstruction is present. Many cases are less acute, spasm is not so complete but lasts longer, so that the stridor persists for several hours. The attack may occur once or recur at intervals for years; there is a tendency to improvement, and most cases finally become cured.

As a great rarity, spasm of the *trachea* has been observed to cause dyspnoea, and the contraction has even been seen with the laryngoscope.

Treatment.—The exciting cause should be found and treated, when possible. All sources of irritation must be avoided, such as smoking or drinking cold fluids. A general hygienic régime is indicated and change of air is often useful. The inhalation of amyl nitrite frequently gives relief during the

spasm, which also disappears under chloroform. When the attacks persist or recur frequently the bromides or chloral may be given, and ipecacuanha in sufficient doses to cause nausea will usually allay the spasm. Tracheotomy or intubation is seldom called for.

Laryngismus stridulus is a spasmodic affection which occurs in ill-nourished, unhealthy children, and usually in association with rickets ; it is commonest between the ages of six months and two years, but may persist later. The predisposing cause is an increased excitability of the nervous system, and the exciting cause of the reflex comes either from the alimentary tract, gastritis, worms, etc., or from the pharynx, especially from the presence of adenoid vegetations. The attack begins with a few short noisy inspirations followed by complete cessation of breathing, and ends with a long crowing inspiration. During the apnoeic stage there are all the signs of asphyxia, and often carpo-pedal contractions ; the termination is sometimes fatal, especially in the "silent" cases, in which the spasm is so tight as to allow no air to

enter. The attacks vary much in frequency and may recur several times in one day. Nurses speak of the attack as a "passion-fit" or as "holding the breath," and it has also been called "false croup."

Diagnosis.—In the intervals there is nothing abnormal, no hoarseness or cough such as is present in spasmodic laryngitis or laryngeal papilloma. Congenital laryngeal stridor is persistent and does not come on in paroxysms, while the peculiar purring noise is distinctive. If the patient is not seen during an attack, the history of the case may suggest epilepsy; in the latter the mouth is clenched, there are usually general convulsions, and the breathing is not completely interrupted.

The *treatment* consists in careful attention to the general health and diet; overloading of the stomach is to be avoided, feeding must be at regular intervals and in moderate quantity, and regular action of the bowels must be ensured. The drugs ordinarily given in rickets should be prescribed. Change of air, especially to a higher locality, is of great value in bad cases; Schmidt has found benefit in moving

the child to the top floor of the house. During the attack inhalation of nitrite of amyl should be tried; cold water may be poured on to the head, and the child put into a hot bath. The quickest method of relieving the spasm is to hook the epiglottis forward with the finger, and the mother may be taught to do this herself; stimulation of the conjunctiva or of the nasal mucous membrane may have the same effect.

Dysphonia spastica, or **Phonic Spasm**, is an occupation-neurosis allied to writer's cramp, and is decidedly rare. It generally occurs in nervous people and in professional voice-users. On attempting to phonate the cords come into close contact, so that no air passes out through the glottis and no sound is emitted. The adduction usually ceases on desisting from the attempt, but sometimes persists and causes an ordinary attack of glottic spasm. In slighter cases the voice can be produced interruptedly and the vowel sounds are apt to be doubled; but it differs from ordinary stammering in that, in the latter, whole sentences can be spoken normally when once the speech is

begun, which is not the case in this affection. The treatment is unsatisfactory, and consists in rest, tonics, and especially lessons in voice-production.

Ictus Laryngis or Laryngeal Vertigo.—

This rare affection begins with a cough or fit of coughing; this is followed by spasm of the glottis, with loss of consciousness, which is regained in a few seconds without confusion or stupor. There is no real vertigo, but the patient may fall down. The cases closely resemble *petit mal*, but they occur in people who never have any other form of fit, there is no after-confusion, and the onset is always with cough and glottic spasm. The unconsciousness is probably due directly to the glottic spasm, for it is well known that forcible expiration against resistance will produce a similar effect.

General hygienic measures, the exhibition of bromides, and the removal of any source of irritation, are the indications for treatment.

Nervous Cough, also called the “barking cough of puberty,” is of the nature of a “tic convulsif,” and affects adolescents of both sexes.

The characteristic cough is loud, "barking," and single, without expectoration, and recurs persistently, ceasing during sleep and if the attention is distracted. Before making the diagnosis any local cause of irritation must be excluded, whether in the lungs, trachea, larynx or pharynx.

A very similar cough may occur in patients of all ages as a result of reflex irritation. The origin of the reflex may be, as is well known, in the ear, in the nose, or any part of the respiratory tract, in the intestinal tract, or even in the bladder; the "stomach-cough" is a familiar instance.

The nervous cough must be treated on general principles, and any really marked source of irritation should be removed. The patient can do much to suppress the cough by an effort of will, especially if he take and hold a deep breath as the impulse to cough is coming on.

SENSORY NEUROSES

Anaesthesia may be complete or partial and may affect the entire larynx or one half of it, or it

may be confined to one region such as the epiglottis. It may be the result of injury of the superior laryngeal nerve or the vagus, of syphilis and of neuritis, especially from diphtheria, or it may be due to bulbar disease, tabes dorsalis, general paralysis, or syringomyelia. The motor nerves of the larynx will usually be involved as well, and often also other cranial nerves. The result is that food tends to enter the larynx and, in incomplete anaesthesia, to cause spasm; in cases of total anaesthesia, the food will reach the lungs and cause obstruction or deglutition pneumonia. The prognosis is very bad, therefore, in cases of total bilateral anaesthesia. The diagnosis is readily made with a probe, but slight and partial cases cause no obvious symptoms and are doubtless often overlooked.

Treatment.—When due to a remedial cause, such as syphilis or neuritis, appropriate general treatment is indicated, and strychnine and faradization should be employed. The principal point is careful feeding; in unilateral cases the patient should swallow slowly while lying on the sound side. If

this is not effectual, or if the anaesthesia is bilateral, food must be taken through an oesophageal tube ; the tube may easily be passed into the insensitive larynx, and therefore the patient must always be instructed to phonate before food is introduced, to prove that this has not been done.

Hyperaesthesia and **Paraesthesia**, consisting in a feeling of rawness, constriction, tickling or pricking, are not uncommon in neurotic people ; it may be most difficult to persuade such patients that a fish bone is not sticking in the throat. It must be remembered that perverted sensations also occur in locomotor ataxia, and that hyperaesthesia is common in gouty subjects ; as stated by Watson Williams, painful sensations referred to the larynx are sometimes an early manifestation of pulmonary phthisis.

Treatment.—These general causes must be attended to, and also any local disease in the larynx or neighbouring parts. General tonic treatment is indicated ; change of air, and a course of waters or bathing at a spa may be recommended. Active local treatment is not advisable, and sedatives like

cocaine and morphia must on no account be prescribed, though a simple nebula containing menthol may be used. On the whole, the treatment of marked cases is very disappointing.

CHAPTER VII

STENOSIS

LARYNGEAL STENOSIS

THE lesions, which cause narrowing of the lumen of the larynx, are numerous, and may be grouped under the following heads :—

1. *Inflammatory Swelling*.—Oedematous laryngitis, especially in children, abscess, perichondritis and traumatism.

2. *Granulomata*.—Syphilis, most often of the chronic infective diseases, causes stenosis; it usually acts by producing cicatricial contraction, but gummatous infiltration may also cause distinct obstruction. Marked obstructive dyspnoea is rare in tuberculous laryngitis, but occurs occasionally as the result of infiltration of the arytenoids. Scleroma, leprosy and glanders all tend to stenosis, but are rarely seen in this country.

PLATE X.



Fig. 1.—Traumatic Cicatrix
after a bullet wound.

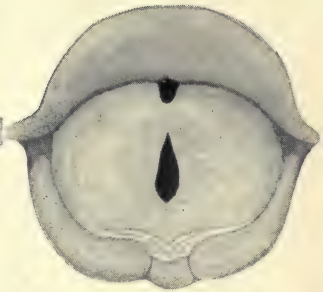


Fig. 2.—Syphilitic Stenosis
(St. George's Hospital Museum).

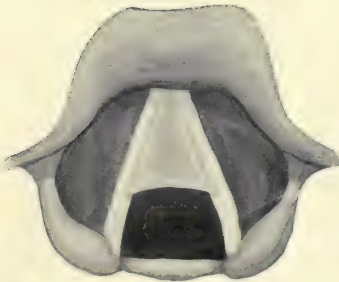


Fig. 3.—Congenital Web.



Fig. 4.—Congenital
Laryngeal Stridor.

3. *Neoplasms*, especially epithelioma, and, in children, multiple papillomata.

4. *Foreign bodies*, and the false membrane of diphtheria and membranous laryngitis.

5. *Cicatricial Contraction*.—This may result from traumatism of any kind (Plate X, Fig. 1), but is especially liable to occur after thyrotomy; the anterior parts of the cords may become adherent or a web of various size form across the anterior commissure. The cicatrix, which forms after excision of the vocal cord by thyrotomy, and which sometimes produces a new cord indistinguishable from the old one, is a remarkable instance of useful scar-tissue.

Syphilis is, however, by far the commonest cause of cicatricial stenosis; the narrowing is generally about the glottis and may be of considerable depth, reducing the lumen to a narrow oblong tube, or the cords may be adherent in front, or a web may form at or just below the cords. These syphilitic web-formations may be thin, like congenital webs, or very thick and firm; the cartilaginous glottis is usually left free, but occasionally the aperture is

more centrally placed (Plate X, Fig. 2). The arytenoids are often fixed by fibrous tissue, so that they cannot abduct properly.

Lupus may produce marked stenosis, as also may leprosy, when the narrowing may affect the upper aperture of the larynx ; and a very troublesome contraction sometimes results from perichondritis, and from the necrosis caused by typhoid fever.

6. *Non-inflammatory Oedema*.—Renal disease is the most important cause of this form of swelling, for it may occur in acute or chronic nephritis, be the first symptom to attract attention, and come on so suddenly as to cause fatal asphyxia before aid can be summoned. Heart disease less often causes marked oedema, and only when far advanced. Angeio-neurotic oedema occurs in the larynx ; it comes and goes with peculiar rapidity, and usually alternates with swellings of other parts ; it can produce severe dyspnoea. The old name “oedema of the glottis” is incorrect, for all oedematous swellings affect either the loose tissues of the upper aperture, or else the subglottic region, but not the glottis itself.

7. *Spasm of the Glottis*.—This is discussed in Chapter VI; it is a factor which increases the stenosis in many of the lesions already mentioned.

8. *Abductor Paralysis* and *fixation* of the arytenoid. These, when unilateral, do not cause severe dyspnoea in the adult except after exertion.

9. *Congenital Malformations*, as a cause of stenosis in children, are described later in this chapter.

TRACHEAL STENOSIS

The causes of tracheal stenosis may be divided into *extra-tracheal* and *intra-tracheal*.

1. The lesions which compress the trachea from without are tumours of the thyroid, innocent and malignant, aneurysms, mediastinal growths, enlarged lymphatic glands, and hypertrophy of the thymus in children; more rarely massive pericardial or pleural effusion and dilatation of the left auricle. The cartilages of the trachea become gradually softened by pressure and are then readily bent inwards. Compression of the trachea by a goître can be well seen with the mirror, in bilateral cases the side-to-side compression produces the

typical "scabbard-shaped" stenosis ; when only one lobe is affected the antero-lateral aspect of the trachea is pressed inwards. An aneurysm will compress the trachea near the bifurcation, and the narrowing, or even a pulsating area may be seen ; when an aneurysm opens into the trachea it usually does so very gradually, and a slight leaking of blood is the first symptom and may go on intermittently for many days before the final rupture.

2. The trachea may be occluded from various causes acting within its lumen :—

Foreign bodies and diphtheritic membrane ;

Inflammatory and angeio-neurotic swelling and traumatism ;

Syphilis, tubercle, lupus, etc. ;

Neoplasms—these are rare within the trachea, but malignant growths of the thyroid gland not uncommonly penetrate the tracheal walls and sprout into its lumen ;

Cicatricial contraction after tracheotomy and cut-throat, and following syphilitic ulceration.

Of these lesions the only common ones are foreign bodies and diphtheria, gumma and cicatricial

PLATE XI.



Fig. 1.—“ Scabbard-shaped ”
Compression of Trachea
by a Goitre.

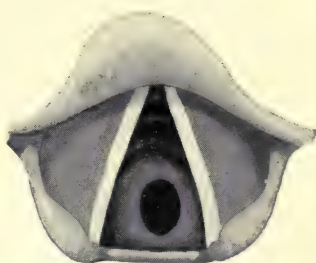


Fig. 2.—Syphilitic Cicatricial
Stenosis of Trachea.

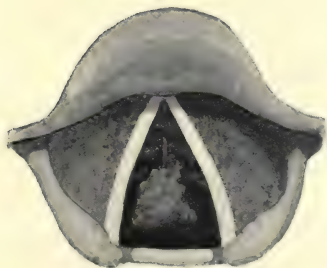


Fig. 3.—Granulations in the
Trachea after Tracheotomy.

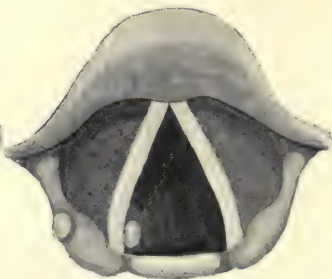


Fig. 4.—Vesicles in Larynx,
associated with Herpetiform
Eruption in Mouth and
Pharynx.

stenosis following syphilis and tracheotomy. In cicatricial stenoses one can generally see a round or oval dark hole in the middle, or at the side, of the lumen, surrounded by a sharp white border of scar-tissue, quite different from the rounded projection caused by pressure from without.

Stenosis after tracheotomy, causing difficulty in removing the tube, may be due to several causes, such as sprouting granulations, kinking of the posterior wall, depression of the anterior wall, or cicatricial contraction following ulceration. Difficulty in removing the tube is, however, rarely due to any physical obstruction, but far more often to nervousness and terror, which produce glottic spasm as soon as the tube is taken out.

Stenosis in children is produced with comparative ease on account of the small size of the air-passages, the liability to spasm of the glottis, and the softness of the tracheal walls. Thus laryngitis often causes dyspnoea in children, and unilateral abductor paralysis is accompanied by considerable obstruction in a child, whereas in an adult the symptoms are very slight; the trachea is not infrequently

compressed by such causes as great pleural or pericardial effusion, which rarely occasion stenosis in the adult.

Symptoms.—The chief symptom is naturally dyspnoea, at first only on exertion but later becoming continual. Cases of laryngeal stenosis sit propped up with the head thrown back; there is inspiratory stridor, while expiration is comparatively easy, and this is owing to the shape of both glottis and upper aperture, which have the effect of a valve. The larynx is drawn distinctly downwards during inspiration, and the voice is generally affected except when the dyspnoea is due to abductor paralysis.

In tracheal stenosis, on the other hand, the patient often sits with the head thrown forwards to avoid stretching, and so narrowing, the trachea; the stridor is both expiratory and inspiratory; the larynx does not move on respiration, and the voice is weak but not hoarse.

Treatment.—The treatment of many of these conditions is discussed under their respective headings; in this chapter it is proposed to deal

only with such cases of cicatricial contraction as result typically from syphilis and after tracheotomy. The treatment of these cases is always difficult and troublesome, and affords scope for much ingenuity in adapting the methods to individual cases. In syphilitic cases it is most important that the lesions should first be thoroughly healed, lest the disease break out afresh, and it is wise to give antisyphilitic treatment before and during dilatation. As regards stenosis after tracheotomy, it has been said already that difficulty in leaving out the tube is due far more often to psychological than to physical causes, and is seldom seen when tubes are removed early, as is now possible in most cases of diphtheria. Such cases should wear a vulcanite tube with a fenestration, and should be encouraged to direct the air through the larynx by talking, sounding a whistle, or blowing soap bubbles. A plug may be cautiously inserted into the tube, or it may be shortened until only the flange is worn. If there is real obstruction, the child must be thoroughly examined under anaesthesia, any granulations removed, and silver nitrate

applied ; and, if kinking or cicatricial contraction be found, these must be treated by a cannula with an upward extension, as described below.

Stenosis of the larynx and upper part of the trachea may be treated by two varieties of method according to whether tracheotomy is performed or not. Dilatation by the natural passages without tracheo-

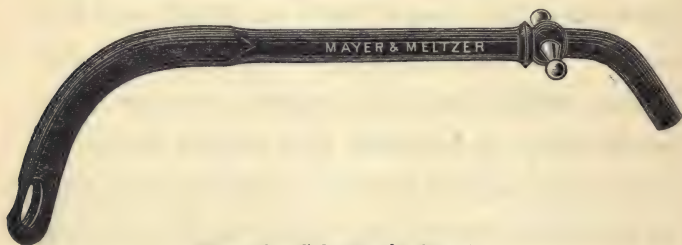


FIG. 16.—Schrötter's Bougie.

tomy may be attempted in the slighter degrees of stenosis in patients who are tolerant of manipulation. Schrötter's vulcanite bougies may be employed ; at first thorough cocainization is necessary, and the patient usually stands the manipulation badly, but later becomes more tolerant. The bougie, which is hollow, should be left in for gradually increasing periods up to half-an-hour, and dilatation with larger sizes, is then

slowly proceeded with. It should be passed daily for some time after the maximum dilatation has been attained, and then at lengthening intervals, the entire treatment often lasting many months ; after a time cocaine can be dispensed with, and some patients can learn to pass the tube for themselves, which greatly facilitates the treatment. O'Dwyer's intubation tubes may be used in the same way ; they can be left in for twelve to twenty-four hours at a time, and gradually larger sizes can be introduced, but care must be taken not to cause ulceration. The thread should always be left attached, as removal is thus easier ; an adult patient is not likely to pull the tube out, and there is some danger of the tube dropping into the trachea as the stricture dilates. Webs should be divided with a cutting dilator, such as Whistler's, and tubes introduced as above until healing is complete.

In most cases, however, tracheotomy should be performed, and the stricture dilated on another plan. In some cases the stenosis may still be dilated from above after tracheotomy. Schrötter's metal plugs are used in this way ; they have a

small button at each end, to the upper one a thread is attached for removal, and the lower one is fixed in the fenestra of the tracheotomy tube by means of a special slit in the inner cannula ; they are passed on forceps from the mouth. For cases of stenosis after tracheotomy an extra long intubation tube may be used ; Killian has fixed a double thread through a hole in the tube, drawn the thread out through the tracheotomy wound and tied it over a roll of gauze, thus holding the tube firmly in place. As a rule, however, when the trachea has been opened, it is better to dilate from below by means of a dilator fixed to the tracheotomy cannula and passing upwards into the larynx. Störk's dilator consists of two sliding arms which can be moved apart ; Schimmelbusch's is flexible, and Thost has devised a good pattern with an introducer to facilitate the insertion of the upward extension. Such plugs should be worn for gradually longer periods and in increasing sizes, great care being taken to avoid pressure ulcers ; and, when dilatation seems to be established, they are very gradually omitted, being worn first every

other day and eventually for one day in the week ; the tracheotomy tube should be kept in for some weeks longer.

It may be said at once that in severe cases all these methods of treatment are most unsatisfactory, and often completely fail ; in most cases it

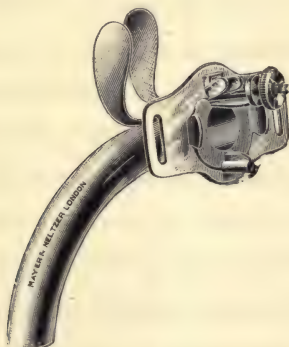


FIG. 17.—Störk's Stenosis Cannula.

is better to perform thyrotomy, thoroughly excise the scar-tissue, and retain a metal plug attached to the tracheotomy tube in the larynx for several months.

Stenosis of the lower part of the trachea, usually the result of syphilis, is most difficult to treat ; but as it must end fatally if left alone, every effort

should be made ; and, though apt to recur, such stenoses have been successfully attacked. Tracheotomy should be first performed and attempts made to dilate the stricture with bougies passed through the wound after thorough application of cocaine ; more than one case of dilatation of stenosis of a bronchus has been recorded. Killian's tracheal and bronchial tube-specula have rendered both the diagnosis and treatment of these conditions much simpler ; the stricture can now be dilated and its edges notched under direct inspection. The only alternative is to perform a low tracheotomy and use a long tube passing through the stricture ; König's flexible metal cannula is a good pattern.

CONGENITAL MALFORMATIONS

Certain congenital malformations which produce stenosis may be described here, together with a form of tracheal compression in children, which has many features in common with the former.

Congenital Webs are decidedly rare ; they are similar to, but usually thinner than, the cicatricial webs which result from syphilis, and, like them,

occupy the anterior commissure and reach backward for a variable distance, but always leave the cartilaginous glottis free. If at all extensive they cause congenital hoarseness as well as dyspnoea, symptoms which can otherwise be only due to papillomata. The web is the remnant of the epiblastic mass which fills the foetal larynx and is absorbed gradually from behind forwards. The treatment is on similar lines to that of cicatricial webs (Plate X, Fig. 3).

Congenital Laryngeal Stridor.—Considerable uncertainty has existed as to the nature and pathology of the cases classed under this heading. The affection has been attributed to adenoids, glottic spasm, pressure of diseased bronchial glands, and to compression of the trachea by an enlarged thymus, and the disease has even been called “thymic asthma.” But there is no doubt that a group of cases exists, the symptoms of which can not be explained by pressure on the trachea, and which are, in fact, due to a congenital peculiarity of the upper aperture of the larynx. These cases alone should be called congenital laryngeal stridor.

In them the normal infantile shape of the aperture is exaggerated, so that the epiglottis is sharply folded on itself and the aryteno-epiglottic folds are almost in contact ; this reduces the opening to a narrow vertical slit, and, as these parts are very flaccid in infancy, they become sucked together during inspiration, and by their vibration produce the characteristic stridor (Plate X, Fig. 4). The characters of the complaint are well defined, and serve to distinguish it clearly from other forms of obstruction. It is truly congenital, and is noticed at birth or seldom later than the seventh day ; it begins to improve about the sixth month, and almost always disappears during the second year. The stridor is *phonatory*, of a peculiar purring character, and gradually rises in pitch during inspiration ; expiration is usually silent. There is a remarkable absence of signs of dyspnoea ; the mouth is closed, the alae nasi quiet, there is no cyanosis or distress, and not as much retraction of the thorax as the amount of stridor would lead one to expect ; in fact, there is more noise than obstruction. The stridor is least marked when

breathing is quiet, but does not usually quite disappear, even during sleep. The voice is unaffected. The prognosis is very good ; there is no risk to life except inasmuch as the affection increases the danger of such diseases as broncho-pneumonia.¹

Tracheal Compression is undoubtedly also a cause of dyspnoea in children ; the compressing agent is usually an enlarged thymus or diseased bronchial glands. This affection is hardly ever truly congenital, but begins some days at least after birth. As in congenital stridor, the voice is unaffected, but, in contrast, the stridor is high-pitched and occurs in expiration as well as during inspiration ; when the stenosis is considerable there is true dyspnoea with distress and cyanosis and with marked retraction of the ribs and epigastrium. The affection is dangerous and the prognosis is bad.²

¹ For a good description and full references, see O. Cozzolino, *Archives internationales de laryngologie*, July-August, 1905, p. 52.

² Hochsinger, *Stridor thymicus infantum*, Vienna, 1904.

CHAPTER VIII

OPERATIONS

INTUBATION

THIS operation is most often employed for the relief of acute and short-lived stenosis, such as diphtheria or oedematous laryngitis, and it is therefore usually performed on children.

The instruments required are an introducer, an extractor, and a set of O'Dwyer's tubes. The tube is made of gilt metal and has a slight swell about the centre to pass below the cords and hinder its expulsion on coughing ; the rounded head, irregular in shape, is designed to lie in the vestibule of the larynx with the broadest part of the flange directed backwards, there is a small perforation in the head to receive a loop of silk. The tubes are of various sizes, and a scale is supplied to assist in

selecting the right one, as a correct fit is important ; the smallest, for an infant up to a year old, is $1\frac{1}{2}$ inches long, and a child of five or six requires a

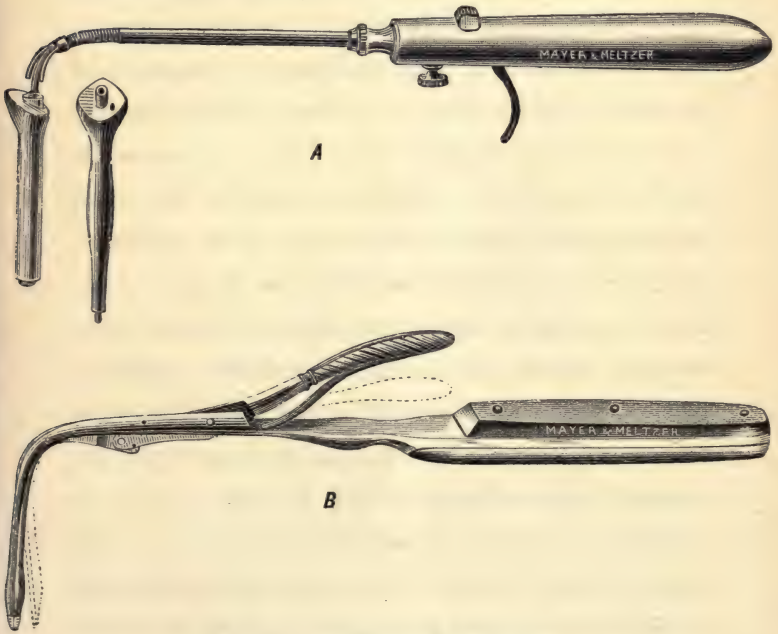


FIG. 18.—Intubation Instruments.

tube about $2\frac{1}{4}$ inches in length. The introducer has an end to fit the lumen of the tube and a sliding tube which helps to push it off when in position.

The extractor is like a laryngeal forceps, but that the blades separate on pressing the lever.

No anaesthetic is desirable, but, with a tractable child, the application of cocaine is of advantage. It is rather easier to intubate with the patient in the sitting posture, but in weakly children, and especially diphtheritics, it is much safer to operate with him lying down; in any case, he must be firmly wrapped in a blanket to confine the limbs and the head must be held still by an assistant. The gag is inserted in the left side of the mouth, and the surgeon introduces the left index finger into the throat and hooks forward the epiglottis; he then passes the tube with a silk thread attached on its introducer along his index finger over the epiglottis and, slightly tilting its end forward by raising the handle, down into the larynx. The tip of the left forefinger is next placed on the head of the tube to keep it in position, and the introducer is at once detached and withdrawn. The gag should now be relaxed, and the surgeon must make sure that respiration is satisfactory; if this is so, after a few minutes' pause he cuts and re-

moves the silk thread, passing his finger again down to the tube to prevent it being pulled out. The thread should not be left in position, because the child may pull the tube out by means of it ; it is only fixed to the tube to facilitate its rapid extraction in case the intubation is unsuccessful.

This little operation requires a good deal of dexterity, as rapid introduction is essential, for breathing is necessarily suspended during its performance ; if, therefore, the tube is not in position in five or ten seconds, the surgeon must remove it and pause before making another attempt. The sound of the air passing through the tube and the relief of dyspnoea make it clear that all is well. The tube may be passed into the oesophagus, but no harm results if it be quickly withdrawn by the thread. The tube, correctly introduced, may be occluded by a piece of membrane pushed down before it, so that the dyspnoea is not relieved ; it must be at once withdrawn by the thread in order that the membrane may be expelled ; if it is not, tracheotomy will be urgently necessary. Therefore tracheotomy instruments should always be at

hand when intubation is attempted. Laceration of the parts only occurs when unjustifiable force is used.

Extubation is performed in a similar way. The gag having been inserted, the surgeon passes his left forefinger down to the tube, introduces the extractor into its lumen, and grasps the tube by separating the blades. This is often by no means easy; a too small tube has been pushed down into the trachea, and the tissues have been torn by opening the extractor outside the tube.

After-treatment.—As a rule the patient very quickly becomes accustomed to the tube, and its presence is not felt. If it becomes occluded it is at once expelled by coughing, and the dyspnoea may quickly return. The tube is apt to cause ulceration if left too long, and it may also become covered with a calcareous deposit and cause lacerations during its extraction. It should, therefore, never be left for more than three days, preferably forty-eight hours; it must then be removed and a fresh one inserted, after which it should be changed at least every other day. If the manipu-

lation is skilfully performed, the child will often tolerate it extremely well. It should, of course, be dispensed with as soon as possible ; in diphtheria more than one or two re-insertions are seldom necessary, but it should be retained as long as any membrane is coughed up ; after all the membrane has disappeared the surgeon may, on removing the tube, wait and see if the breathing is quite free ; he must intubate again on the slightest sign of obstruction, and should remain within reach for some hours. If a tube has to be kept in for many days, a rubber tube is recommended, and this should be coated with a hot solution of gelatine containing 10 per cent. of alum or ichthyol.

The chief trouble is the difficulty in swallowing which almost always results, at any rate for the first few days ; liquids especially being liable to enter the trachea. Older children should be fed with thickened fluids and semi-solids, and should be instructed to gulp their food slowly or to suck it up through a tube while lying on the face, after Wolfenden's method (p. 92). Infants should be

fed by the nasal tube, and sometimes rectal feeding must be employed, but is to be avoided if possible in diphtheritic cases, as they require ample nourishment.

Intubation is especially adapted for cases in which the obstruction is not expected to last long, as in cases of diphtheria under the antitoxin treatment and for acute oedematous laryngitis, and is in general unsuited for cases of more chronic disease especially accompanied by ulceration, as tubercle and syphilis, but it has been used successfully for the treatment of stenosis caused by the scars of the latter affection. In diphtheria it appears to be safer than tracheotomy for children under five; but one cannot judge much by statistics, for intubation can, and should, be performed earlier than tracheotomy. Besides the trouble with deglutition, the great risk is that, if the tube be coughed out, urgent dyspnoea may supervene; this is not common, but nevertheless tracheotomy is to be preferred if a medical man is not always immediately within reach.

TRACHEOTOMY

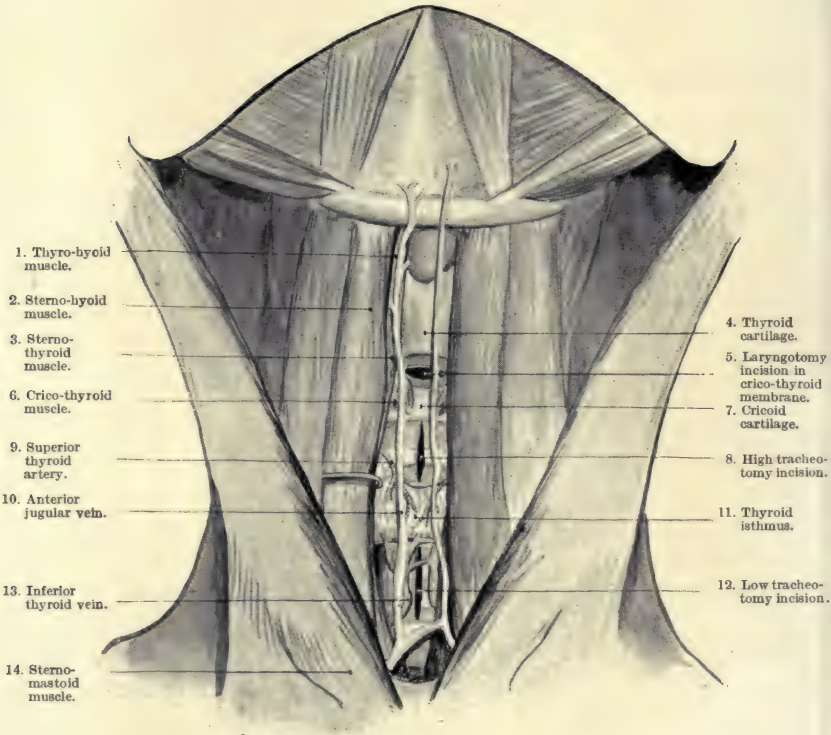
An anaesthetic is advisable unless the asphyxia is extreme ; chloroform or the chloroform-ether mixture should be chosen, and should be given very slowly. A sandbag is placed under the neck and shoulders to bring as much of the trachea as possible above the sternum and to render it prominent ; the full distance, on extension, from the cricoid to the sternum averages $2\frac{3}{4}$ inches in an adult, and $1\frac{1}{2}$ inches in a child three or four years old. The patient must be quite straight, so that the chin, thyroid notch and sternum are in the same line, and to the anaesthetist falls the important duty of keeping the head in this position. The surgeon stands on the patient's right side and takes the thyroid cartilage between the thumb and middle fingers of the left hand, placing the index finger on the thyroid notch to steady the trachea and mark the middle line.

The operation is called high or low tracheotomy, according as the trachea is opened above or below the thyroid isthmus which covers the second, third,

and sometimes the fourth tracheal rings. But there is no hard and fast line between the two operations, for there is no objection to dividing the isthmus, and, indeed, it is often advisable to do so and to open the trachea immediately beneath it. The trachea above the isthmus is nearer the surface and more quickly reached, and sepsis is less likely to spread from thence to the mediastinum, therefore the high operation is usually performed; but low tracheotomy must be performed for cases of foreign body in the bronchus and for cases of stenosis which may extend into the trachea. Low tracheotomy is preferred by many operators for cases of diphtheria which are not extremely urgent, with the idea that the tube is less apt to become blocked by membrane, and that there will be less likelihood of difficulty in dispensing with it later.

High Tracheotomy.—The incision, about two inches long, is made strictly in the middle line downwards from the level of the crico-thyroid membrane. In the subcutaneous tissue the anterior jugular veins lie on either side, there is no

PLATE XII.



The Anatomy of Tracheotomy.

need to wound them, but connecting branches cross the middle line and are divided. The superficial layer of the cervical fascia is next cut, and the surgeon opens the lozenge-shaped space between the sterno-hyoid and sterno-thyroid muscles of each side ; if the middle line is kept, no muscle

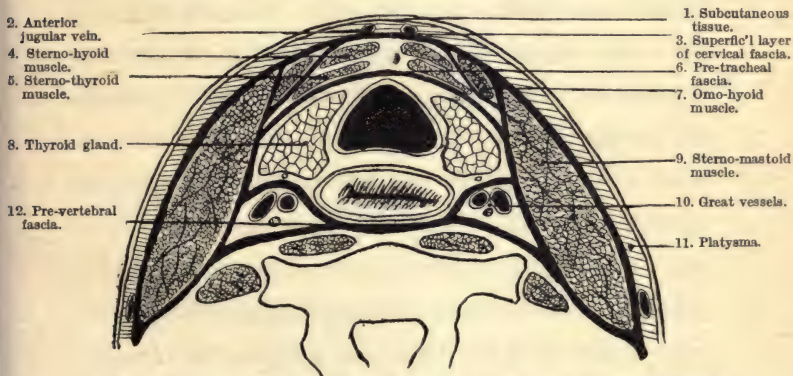


FIG. 19.—Section through the neck, just below the cricoid cartilage.

fibres are divided. The muscles are retracted, taking care not to pull the wound out of the middle line, and the trachea and thyroid isthmus are now seen beneath the strong pre-tracheal fascia ; this may be divided vertically, but, if time allows, it is better to detach it by a transverse incision along

the cricoid cartilage and to push it, and the thyroid isthmus, downwards with the handle of the scalpel ; in this way troublesome oozing from the numerous small veins is prevented. The trachea is now well exposed, the cricoid cartilage is fixed and drawn up by means of a sharp hook, and the surgeon inserts the knife, with its edge directed towards the chin, below the second ring and divides the trachea from within outwards and upwards towards the hook. The right margin of the cut trachea is held with forceps in the left hand, and with the right the tube is introduced. An excellent plan, if there is no great urgency, is to pass a pair of sharp hooks around one of the tracheal rings, one on each side of the middle line ; on incising the trachea the wound can be at once held widely open, and this facilitates the expulsion of membrane and is of especial value in cases of foreign body, which may be at once coughed out (Chapter X).

Low Tracheotomy is performed in a similar manner. The incision runs from the cricoid to the sternum, the inferior thyroid veins lie over the trachea, and the innominate vein may rise above

the sternal notch. The pretracheal fascia is divided vertically, and it is also advisable to incise it transversely just below the thyroid isthmus, which can then be well pulled up and retracted.

Difficulties.—Tracheotomy on the cadaver or on a normal adult is extremely easy, but, in the flurry and excitement of operating hurriedly on a fat-necked infant in the last stage of asphyxia, extraordinary accidents and mistakes have occurred. The chief points are to keep the patient quite straight, to cut only in the middle line, to clearly feel the rings of the trachea before opening it, and to incise the trachea from within outwards. When once the trachea has been opened, the lips of the wound can be held apart with forceps or hooks and the tube may be introduced at leisure ; indeed, in cases of foreign body or where there is much membrane, it is often better to keep the wound open with Parker's or Golding Bird's retractor, and to use no tube for a time. The haemorrhage is often free ; it is almost entirely venous, and due to the congestion resulting from dyspnoea. When there is no urgency, all bleeding should be arrested before

the trachea is opened ; but when there is dyspnoea venous bleeding should be neglected, for it diminishes as soon as free respiration is established. A serious mistake is to make the tracheal opening too small, for much damage may be done by attempts to force the tube through the wound, and it may even be pushed down between the tracheal fascia and the trachea ; the soft rings of an infant may be pushed inwards, so that the trachea assumes a half-moon shape, and stenosis and difficulty in removing the tube will result. Free respiration may not follow, even when the tube is in position in the trachea ; either the tube is of the wrong shape and its end impinges on the tracheal wall, or else it has pushed down membrane before it, or the membrane has extended right down the trachea. The tube must be taken out at once and the wound retracted ; in the first instance another tube is tried ; in the second, attempts must be made to remove the membrane with forceps, aspirator, or a small horsehair probang.

The Tube.—A correct pattern is of importance ; those made in the form of the segment of a circle,

such as Fuller's, are bad because the end presses on the front wall of the trachea, and may produce severe ulceration, which has been known to involve the innominate artery; the bivalve outer tube of Fuller's pattern is unnecessary, for introduction is quite easy without it. Parker's tube is of the correct shape; Durham's has a movable shield

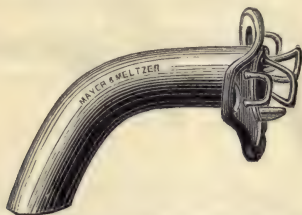


FIG. 20.—Parker's Tracheotomy Tube.

which allows it to be fixed at any depth to fit the trachea, and is especially valuable when low tracheotomy has been performed; there should be a fenestra in the upper wall of the tube so that air can pass through the larynx and the tube be closed with a cork preparatory to removing it. The correct diameter of the tube for an adult is 12 to 15 mm., from 12 to 15 years the diameter should be 12 mm., for 8 to 12 years it should be

10 mm., 8 mm. from 4 to 8 years, 6 mm. from $1\frac{1}{2}$ to 4 years, and under $1\frac{1}{2}$ years the diameter should be 4 mm. (25 mm. are equivalent to nearly 1 inch).

After-treatment.—The tube is threaded with

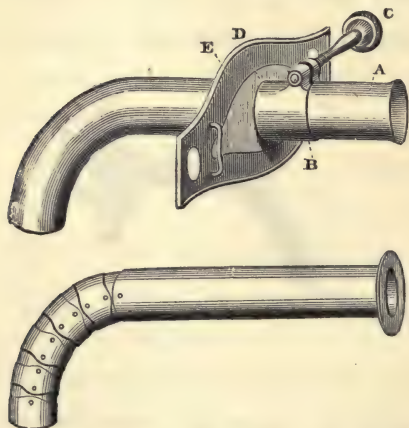


FIG. 21.—Durham's Tracheotomy Tube.

tapes, which are tied round the neck to keep it in position; the wound is dressed beneath the flange of the tube with boracic ointment or gauze, and a single layer of gauze should be lightly laid over the tube and changed as often as it becomes soiled. A special nurse must be constantly in attendance

to see that the tube is clear ; the inner tube must be removed and cleaned three times a day, the outer tube should be left for the first 24 or 48 hours and then changed every day or every two days, according to the amount of discharge. If the trachea is blocked by membrane, removal of the tube will often excite cough and encourage its expulsion ; tickling the trachea with a feather will have the same effect, but this should not be done often or indiscriminately ; the bronchi have been found full of feathers post mortem. In bad cases forceps, a probang, or a tracheal aspirator are required. The tube must, of course, be dispensed with as soon as possible, for the longer it remains in, the more difficult it becomes to take it out ; in cases of diphtheria it may now generally be removed in from two to four days, but one must first be convinced, by closing the tube with a cork, that respiration is quite free. A silver tube must be worn as long as membrane is present. In cases who have to wear a tube for a long time or permanently, a rubber tube should be substituted after some ten days, when the opening has become rigid.

Difficulty in removing the tube sometimes occurs ; this is usually due to nervousness and spasm rather than to actual obstruction. The management of these cases is discussed on p. 185.

LARYNGOTOMY

This operation can be easily and rapidly performed ; it should not be done where a tube is to be retained for more than a few hours and is unsuitable for children under five, for the crico-thyroid space is then too narrow. It is the operation of choice for cases of dyspnoea due to foreign body impacted in the larynx or to fracture of the thyroid cartilage, for the foreign body may be pushed up from the wound or the incision may be extended to the thyroid cartilage to remove an impacted body or to suture the broken fragments. It is also a very convenient method of temporarily opening the air-tube before proceeding to an extensive operation about the mouth, nose or pharynx.

The position of patient and surgeon is the same as for tracheotomy ; a vertical incision, an inch or less in length, is made over the crico-thyroid

space, the deep fascia is divided and the borders of the crico-thyroid muscles slightly pushed outwards ; the crico-thyroid membrane is then incised transversely and the tube, which is flattened from before backwards, introduced. A crico-thyroid artery, large enough to need a ligature, is seldom met with.

THYROTOMY

This operation consists in splitting the thyroid cartilage in the middle line to obtain access to the interior of the larynx. It is usually performed for early epithelioma or to remove an impacted foreign body ; but it is sometimes employed in the treatment of innocent growths, syphilitic stenosis and tuberculosis.

A preliminary tracheotomy is performed, and this should generally be done at the same time as the major operation.

The incision is made in the middle line from the hyoid bone down to a point just above the sternal notch. The cut is deepened to the cartilages and the tissues dissected off the thyroid cartilage for

half an inch on each side. All bleeding having been arrested, the trachea is opened at about the third and fourth rings, and for this purpose the thyroid isthmus must be divided; for if tracheotomy be done above the isthmus the tube is apt to get in the operator's way. A tampon-cannula may be used; Trendelenburg's and Semon's have an inflated rubber bag which blocks the trachea, and Hahn's is covered with a dehydrated sponge which swells up when wet. The former kind may become deflated, and the latter takes time to swell. I much prefer to use an ordinary tube and to occlude the trachea with small pieces of sponge which can be changed as required; these sponges have each a long silk cord firmly stitched into them, not simply tied around. A superficial transverse cut should be made on the thyroid cartilage, or a stitch-hole drilled through it, so that it may be subsequently sutured in correct position, for it is most important that the level of the cords be not disturbed. The crico-thyroid membrane is then incised and one of the sponges inserted and pushed downwards. The thyroid is next split strictly in

the middle line so as not to damage the cords ; this should, therefore, be done from within outwards by a curved probe-pointed bistoury passed from the crico-thyroid space up between the cords ; if the cartilage is ossified Waggett's thyrotomy shears are very convenient. A second sponge is then inserted, and the laryngeal disease treated as required. The two halves of the cartilage should be well retracted ; and the application of cocaine and adrenalin is useful to arrest haemorrhage and diminish irritability. The thyroid cartilage should then be accurately sutured with stout chromicized catgut or kangaroo tendon, if ossified a drill or bradawl is required. As a rule the tracheotomy tube may be removed at once ; the lower stitches are inserted but not tied, the patient is allowed to come partially round and then the tube is taken out and the wound adjusted. In this way any slight oozing causes no danger, for the coughing reflex has returned ; a fine drainage tube is inserted into the lower part of the wound to prevent emphysema.

After-treatment.—The head should be kept low

for twenty-four hours to help any oozing to come up into the mouth. Unless the laryngeal wound involves the upper aperture, there is no difficulty in swallowing, but it is always wise to first give a few spoonfuls of boiled water, for this will do no harm if it does enter the larynx.

LARYNGECTOMY

Total laryngectomy will be first described because the unilateral operation is rarely called for and has a higher mortality, owing to the impossibility of shutting off the pharynx.

The operation used to be performed in such a way as to allow of an artificial larynx, an upward extension from the tracheotomy tube into the pharynx. But in this way discharges from the pharyngeal wound passed directly into the trachea, and the mortality from pneumonia was consequently very high. In the modern operation the pharynx is sutured and the risk is much less ; no air passes from the lungs to the mouth, but after a time the patient can usually learn to fill the pharynx with enough air to whisper a few words or, better, he

may conduct air from the tracheotomy tube to the lips by an indiarubber tube, and in this way can utter a quite intelligible whisper. Glück has devised a plan by means of which the air is conducted by a flexible rubber tube from the tracheotomy wound through the nose back to the nasopharynx; a vibrating reed is fitted into the tube and enables the patient to talk with a loud and distinct voice.

Operation.—An incision is made from the hyoid bone to a point about midway between the cricoid and the sternal notch; a transverse incision is made at the upper end of this and another just below the level of the cricoid cartilage; the cuts are deepened to the cartilage and the two rectangular flaps dissected up. It is better not to include the perichondrium in the flaps. At this stage it is always wise to perform a high tracheotomy, split the thyroid cartilage, and examine the growth. The sides of the larynx, and the attachment of the pharynx to it is defined; the trachea is then separated at its upper part from the oesophagus, the knife passed behind it and the

tube severed obliquely from behind downwards and forwards, the lower end being first fixed to prevent retraction with a pair of hooks or silk threads passed around one of the rings. The cut end of the trachea, further freed if necessary, is turned forward into the lower angle of the wound and surrounded by a strip of gauze ; thus isolated it requires no tube or tampon, especially if the Trendelenburg position be adopted. The lower end of the larynx is now seized, pulled forwards and dissected up from the pharynx, great care being taken not to injure the latter. When the aryteno-epiglottidean folds are reached or, if they are infiltrated, when the limit of safety is attained, the mucous membrane is divided into the pharynx ; the epiglottis is separated by cutting through the thyro-hyoid membrane and the mucous membrane between epiglottis and tongue, and the entire larynx is removed. This leaves the divided trachea in the lower angle of the wound and, above, a large gap in the pharynx. This latter is now to be closed ; the mucous membrane is first sewn up, the edges being turned in towards the lumen, and

then the muscular and aponeurotic layer sutured. Below, the line of suture will be vertical, but above, the anterior wall should be brought up and stitched transversely to the base of the tongue ; if much tissue has been removed a gap must of necessity be left here. The soft tissues of the neck are then united, and finally the skin ; chromicized catgut should be used for the buried stitches. The trachea is drawn forwards and stitched all round to the skin and a tracheotomy tube inserted ; a drainage-tube should be placed on each side along the line of pharyngeal suture and firm pressure applied.

Some operators, after dividing the trachea, prefer to remove the larynx by dissecting from above downwards.

After-treatment.—Rectal feeding is advisable for some days, but if there is much debility food should be given by the nasal or oesophageal tube. The patient can usually be fed by the mouth at the end of a week, and the first efforts at swallowing should be made with boiled water. The operation is extremely successful except when large parts of the pharyngeal wall have to be removed.

Partial Laryngectomy.—One half of the larynx may be removed when the disease is unilateral, but the operation involves greater risk. The incisions are similar, but the lateral ones are made only over the affected side. Preliminary tracheotomy is performed and the trachea plugged ; the thyroid cartilage is then split and the disease examined ; the cricoid is divided in front, dissected from the pharynx and divided again behind ; the separation is continued upwards as far as is considered safe and the half of the larynx excised. The epiglottis is removed or left according to circumstances. The larynx is lightly packed with a strip of gauze brought out through a gap in the skin-sutures ; the tracheotomy tube is left in for a week and the packing in the larynx is changed daily and may be omitted after some four days, when the wound is allowed to close. Swallowing is possible after about a week and should be at first performed with the patient lying on the sound side. Speech is soon restored and is usually hoarse but quite distinct.

SUB-HYOID PHARYNGOTOMY

This operation is of limited application, but has been used to obtain access to growths about the epiglottis ; it is easy but affords rather insufficient access.

A transverse incision is made along the lower border of the hyoid bone ; it is deepened to the thyro-hyoid membrane, the sterno-hyoid muscles being divided. The membrane is cut and the mucous membrane between the tongue and epiglottis is incised ; the epiglottis can then be drawn through the wound and dealt with as required, and the incision sewn up.

CHAPTER IX

LARYNGEAL COMPLICATIONS OF GENERAL DISEASES

It is probable that the virus of many acute specific fevers and general infective diseases enters the body through the upper respiratory tract, and the larynx, as well as the fauces, may be affected in these cases. Various skin diseases, too, may attack the mucous membrane of the larynx, and pathological processes due to affections of other organs sometimes show themselves here. Often these laryngeal lesions are of little importance, and are overshadowed by the general disease, but occasionally the local symptoms are predominant and first attract the attention of the patient. In this chapter the most important of such laryngeal complications will be shortly discussed. The paralytic affections of the larynx have already been described in Chapter VI.

Scarlet Fever.—The faucial angina of scarlet fever shows little inclination to extend to the larynx, and indeed laryngeal complications are very rare. The mildest degree takes the form of red, somewhat raised patches, especially on the laryngeal surface of the epiglottis; in severe cases there may be deeper inflammation with swelling and obstruction, and perichondritis may occur and is apt to end in suppuration and necrosis. Membranous laryngitis sometimes results by extension from the fauces and is a very fatal complication; it is due to the streptococcus more often than to the diphtheria bacillus, the relative proportions varying in different epidemics. As a complication of scarlatinal nephritis oedema of the larynx may occur and produce very sudden obstruction.

Measles.—As hoarseness and cough are among the characteristic symptoms of measles, some degree of laryngitis is the rule, but differs greatly in severity in different epidemics. Koplik's spots do not seem to be found in the larynx, but a mottled red rash, the so-called "endanthem," may appear there, as also on the palate and fauces, twenty-

four or thirty-six hours before the cutaneous eruption.

As a rule the local affection is simply a catarrhal laryngitis and, like all laryngitis in children, it may be accompanied by spasm. Severer forms are also found with oedema or subglottic swelling; gangrenous laryngitis has occurred in feeble children, generally in association with cancrum oris. Ulcers have been described on the cords and ventricular bands, also localized patches of coagulation-necrosis associated with masses of cocci and saprophytic organisms. Membranous laryngitis is not very uncommon, and usually does not appear until the period of fading of the rash or of desquamation; this complication is of serious prognostic import; it is very rarely true diphtheria, though antitoxin should be given as soon as membrane is seen, for there is no time to wait for a bacteriological diagnosis.

Variola.—The larynx is always inflamed, but often only as a catarrh. The vesicles have been seen in the larynx, as on the fauces; they pustulate about the eighth day, and pain and hoarseness re-

sult ; oedema may supervene a few days later and cause fatal obstruction, and perichondritis and necrosis also occur, and, if the patient recover, may cause a very intractable stenosis. Membranous laryngitis is fairly common, and occurs about the tenth day ; it is doubtful if it is due to Löffler's bacillus. The pustules leave scars which are visible ever afterwards. Neuritis is a sequela of small-pox and may cause paralysis of larynx and palate.

Varicella.—The vesicles sometimes occur in the mouth, and on the palate and larynx.

Whooping-Cough.—There is no characteristic laryngeal affection ; some laryngitis is often present with redness, especially of the posterior wall, and is probably due to coughing ; submucous hæmorrhages occasionally occur, and a few cases of membranous laryngitis have been reported and appear to have been genuine diphtheria.

Enteric Fever.—Laryngeal complications are common, but, owing to the apathetic state of the patient, often escape notice. The laryngeal affection usually begins about the fifteenth day, and takes the form of an inflammation with a tendency

to superficial necrosis of the mucous membrane and with a predilection for certain sites, the edge of the epiglottis, the vocal processes and the posterior surface of the cricoid plate. The ulceration may extend deeply and involve the cartilages; perichondritis attacks chiefly the arytenoids and posterior half of the cricoid cartilage and results in necrosis; there is a special tendency to subsequent contraction and stenosis of a most intractable nature. Often there is so little redness or swelling that the perichondritis may easily pass unrecognized. Oedema occurs but rarely with or without perichondritis; a membranous laryngitis is occasionally seen.

A few cases, described as "laryngo-typhus," have been recorded in which the local affection overshadows and masks the general disease. A late form of laryngitis is also described, setting in about two months after the fever; it is a severe form and the prognosis is grave.

The authorities are not yet agreed as to the causal agent of these lesions; staphylococci and streptococci are abundant on the superficial ulcers, and they have been considered to be pressure-ulcers

analogous to bed-sores. In other cases, especially of deep ulceration, the typhoid bacillus has been found ; according to Bergengrün the typhoid bacilli are destroyed in the later stages by staphylococci. The ulcers have, on the whole, a predilection for the regions where lymph-follicles abound, a point in favour of their causation by the typhoid bacillus. The question is of importance from the point of view of the spread of infection, and it is probable that this may at times result from the expectoration of a patient with laryngeal complications.¹

Paralysis of the cords has been fairly often observed of late ; it may be complete or of the abductor type, and may affect one or both cords. It occurs late in the disease, or during convalescence, and is due to neuritis or to pressure by enlarged glands.

Influenza.—Acute catarrh of the larynx, as of the pharynx, is very usual ; the appearance is indistinguishable from that of simple catarrh. Little

¹ Watson Williams, *Diseases of the Upper Respiratory Tract*, 4th edition, p. 401.

white patches of superficial necrosis are often seen, especially on the front parts of the cords, but they also occur in severe simple catarrh ; small lenticular grey patches have also been described on the ventricular bands, arytenoids and epiglottis, and on the palate. Oedema and abscess sometimes occur, and haemorrhagic laryngitis is not uncommon. The disease is apt to leave behind it a troublesome chronic catarrh.

Paralysis of the vocal cords is a not very infrequent sequela ; it is generally due to neuritis and of the abductor type. As in diphtheria the palate, and indeed the limbs, may be also affected.

Erysipelas.—The causal agent of erysipelas, the streptococcus erysipelatos, is probably identical with the streptococcus pyogenes which is the cause of the majority of severe inflammatory processes in the throat, but, on the other hand, a clinically indistinguishable inflammation of the larynx may be produced by many various organisms. One might therefore hesitate to speak of erysipelas of the larynx as a specific disease ; but there is a distinct form of laryngitis and pharyngitis, with a sudden

onset and defervescence by crisis and marked redness and oedema of the upper aperture of the larynx. In twenty-four or forty-eight hours the disease spreads by one of the orifices to the skin, and a typical facial erysipelas ensues. Less often, the affection begins as facial erysipelas and extends later to the larynx ; in severe cases of erysipelas the swelling of the cervical region may reach the larynx from without, causing oedema but no true erysipelatous laryngitis. (*See also* p. 28.)

Skin Diseases.—Lupus and leprosy of the throat have already been described (Chapter IV). Several skin affections show themselves, under a somewhat altered aspect, in the throat ; as a rule they attack the mouth, tongue and fauces more readily, but occasionally they appear in the larynx.

Herpes appears to attack the throat the most frequently of these affections. It is doubtful if true herpes zoster occurs, for the lesions are bilateral ; the eruption is rather of the nature of herpes catarrhalis, and is often associated with labial herpes. The cases may be acute, or, rarely, protracted ; the acute form lasts four or five days. The affection is

apt to recur, and some women, according to Kraus,¹ are subject to a slight attack at the menstrual period. In the protracted form repeated relapses take place, accompanied by fresh crops of vesicles. The onset is sudden, the temperature rises rapidly, usually to about 103°, but sometimes much higher, and there may be a rigor; the little vesicles then appear, but, on account of the warmth and moisture, they soon rupture and may never be seen by the surgeon. A greyish-white patch of dead epithelium remains and, when it falls off, leaves a superficial erosion which heals without scarring. I have seen a vesicle in the subglottic region in association with vesicles on the arytenoids, pharynx and mouth (see Plate XI, Fig. 4). At the height of the attack the dysphagia may be extreme, and there is often considerable constitutional disturbance.

The treatment consists of purgatives at the onset and tonics, especially arsenic; locally mild antiseptics such as glycerine and borax or potassium chlorate, with the application of nitrate of silver to

¹ *Die Erkrankungen der Mundhöhle und der Speiseröhre*, Wien, 1897, Heft i., s. 164.

any erosion which fails to heal, and orthoform insufflations if dysphagia is severe. Schmidt recommends the insufflation of thioform as a curative agent.

Pemphigus is almost without exception associated with the disease of the skin ; it affects principally the soft palate and inner surface of the cheeks, but is also found in the larynx. The typical vesicles are hardly ever seen, for they rapidly disappear and give place to a yellowish, slightly raised patch, partly covered by the remnants of the epithelium forming the bleb ; this remains for a long time, but is finally cast off, leaving a red granulating surface which heals with or without the formation of a scar. Adhesion of the palate to the pharynx may result, but scarring or stenosis of the larynx has not been described. The blebs are nearly always multiple and scattered. *Pemphigus* is a serious affection, and the prognosis is bad ; frequent recurrences weaken the patient, who dies from cachexia or some intercurrent affection. The treatment consists in the administration of arsenic in increasing doses up to 20 minims of liquor arsenicalis three times a

day, and then diminishing the dose gradually and increasing it again alternately ; the treatment must be continued for many months. The local treatment is the same as for herpes ; the topical application of silver nitrate may do good.

Urticaria also occurs and causes irritation, cough and dyspnoea, which comes on rapidly and may be very severe. It may precede, follow or alternate with the cutaneous eruption.

Allied to this is *angeio-neurotic oedema*, which may attack the larynx and cause the most severe obstruction.

Erythema multiforme and *erythema nodosum* have also been described in the larynx. All these affections cause swelling of the parts, and can only be diagnosed by their association with cutaneous lesions.

Myxoedema.—I have seen, in a case of myxoedema, a smooth oedematous-looking swelling of the arytenoids and interarytenoid region ; it prevented the proper approximation of the cords and may be the explanation of the husky voice which is common in this affection.

Rheumatism.—The virus of rheumatic fever appears to enter the body by the fauces, and it is well known that follicular tonsillitis is frequently, or even usually, a rheumatic affection. Rheumatism may undoubtedly cause inflammation of the larynx, which in its appearance is, however, quite indistinguishable from simple laryngitis. The disease may also attack the crico-arytenoid joint and be a cause of fixation of the cord. It is possible, as some authors maintain, that by causing a neuritis it may produce true cord-paralysis, but we must be very chary of ascribing paralysis to so indeterminate a cause, as it is seldom possible to exclude other factors with certainty.

Gout.—Laryngitis dependent on the gouty diathesis is by no means uncommon, though perhaps less so than pharyngitis; the attacks may alternate with arthritis. The larynx is of a rather bright red and glazed appearance, and the erythema is patchy in its distribution; rarely a granulating mass occupies the cord and may even simulate epithelioma. Fixation of the arytenoid may occur. A peculiarity, which should arouse suspicion, is the

extreme painfulness of the affection ; a sharp pain shooting to the ear on swallowing, or even on speaking, without any serious visible lesion, is very suggestive of a gouty affection. Marked faucial irritability is also suggestive of goutiness or alcoholism. The treatment is that of gout in general, combined with the use of a sedative inhalation or spray.

Phthisis.—In addition to laryngeal tuberculosis, non-tuberculous laryngeal affections are often seen in consumptive patients. Pallor of the larynx and palate is common ; it is in no way distinctive, but depends on the anaemic condition of the patient, and is also found in other forms of anaemia. Simple catarrhal laryngitis occurs very frequently as a result of coughing and of irritation by the sputum ; it is a condition which causes much anxiety if it persists, for true tuberculous laryngitis may begin in precisely the same way, although in the latter the cords are often unequally affected or some erosion is present. It is probable that persistent laryngitis does increase the tendency to local tuberculous infection, though statistics do not show that occupa-

tions which predispose to laryngeal catarrh increase the proportion of tuberculous laryngitis among consumptives.¹

Catarrh in consumptive patients, therefore, requires the most careful treatment. Every attempt must be made to allay the cough; heroin in doses of $\frac{1}{12}$ to $\frac{1}{8}$ grain in a linctus is of great value; the patient should be instructed to inhibit the cough as much as possible and to use the voice very little; in persistent cases speaking should be altogether prohibited and a slate and pencil provided. Oily solutions in a nebulizer are to be recommended and, if the appearance be at all suspicious of early tuberculous infection, Lake's pigment (p. 95) should be applied without delay.

Some degree of pachydermatous thickening is very common in the larynges of consumptive patients, indeed Gougenheim² considered that most cases of pachydermia are due to tuberculous infection; such thickening is also seen in patients with chronic nasal suppuration as the result of irritation

¹ *Laryngeal Phthisis*, Lake and Barwell, 2nd edition, p. 14.

² *Atlas de Laryngologie et de Rhinologie*, p. 16.

by the pus passing over the larynx, and I believe that the sputum of consumptives may produce the same effect without, of necessity, any infection by the tubercle bacillus. True tuberculous disease of the interarytenoid region is common and must be kept quite distinct.

CHAPTER X

INJURIES AND FOREIGN BODIES

Cut-throat.—Wounds of the larynx and trachea are generally suicidal ; sometimes they are caused by gun-shot injuries and occasionally the larynx is wounded from within by a sharp foreign body or the surgeon's lancet.

Cut-throat wounds are often made above the hyoid bone, where they enter the thickness of the lingual muscles but do not penetrate to the pharynx ; in the thyro-hyoid space, however, they frequently reach the pharynx and injure the epiglottis, which may be partly severed and, hanging over the laryngeal aperture, cause asphyxiation. The thyroid cartilage is not often cut through, but the larynx may be opened below the cords through the crico-thyroid membrane. The upper part of the trachea lies prominently in the neck, and is especi-

ally often cut ; sometimes it is completely severed, when the lower end will retract and severe dyspnoea result. The oesophagus may also be opened. The head is generally thrown well back, and the muscles contracted, while the cut is made, so that the great vessels usually escape ; but there may be profuse haemorrhage from the lingual and superior laryngeal vessels. The superior or inferior laryngeal nerves may be divided, in the latter case paralysis of the cord follows ; in the former the resulting anaesthesia increases the liability to pneumonia from the entrance of food into the larynx.

If the great vessels are severed the patient is usually dead before assistance can be procured. Next to this the greatest and most pressing danger is the entrance of blood into the trachea and lungs ; owing to the patient's collapsed condition this is not coughed out and kills either at once by suffocation, or later by pneumonia. Small penetrating wounds may produce the most extensive emphysema. Later dangers are sepsis and pneumonia ; the patient is usually in a collapsed feeble condition and desires to die, but, if he survive the first shock and hae-

morrhage, he may recover from the most extensive wounds.

The first thing is to arrest the haemorrhage ; if blood is entering the trachea pressure must be at once applied, tracheotomy performed, and the air-passage packed above the cannula with gauze ; if the wound is in the trachea the cannula may be wrapped round with gauze and inserted through the wound ; the strip of gauze must have a silk thread attached to prevent any possibility of its being sucked down into the trachea. Then the divided structures must be carefully approximated ; as the wound is not aseptic, I prefer catgut to silk sutures. If the trachea be severed, or if there be a large wound in it, it should be partly sewn up, leaving room for the tracheotomy cannula ; the skin-wound should also be sutured, provided that adequate provision be made for drainage. If the bleeding can be completely stopped, and blood does not enter the air-passages, it becomes a question whether tracheotomy should be done. This may not be necessary when the cut is small, sharply incised and clean ; but it should

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be remembered that the bleeding may recur, or, if the wound become septic, discharges may enter the trachea or oedema suddenly come on. It is better, therefore, in most cases, to perform tracheotomy and plug the air-tube above the cannula with gauze. During healing the head must be kept well flexed to approximate the parts. If the pharynx or oesophagus has been wounded, it should be carefully sutured with a separate layer of stitches for the mucous membrane, and a drainage tube passed down to the wound; the patient should be fed by the rectum for a few days unless there is much weakness, when food must be given by means of a soft stomach tube. It is wise, on commencing to feed by the mouth, to give a few spoonfuls of sterilized water first; if it passes through the wound it will come out by the drainage-tube and no harm will result. Unless the pharynx or oesophagus have been damaged, there is usually no object in withholding food by the mouth; but it is well first to take the same precaution. Stimulants are often advisable, and saline enemata for the initial shock;

morphia has been advised to restrain cough and restlessness, but there is great danger in diminishing the coughing reflex when blood has been aspirated. If the air of the room is warm, there is little virtue in a steam-tent. Suicidal cases must, of course, be carefully watched. The later sequelae are paralysis of the cords, stenosis, and aerial fistula. Stenosis is discussed in Chapter VII; aerial fistula hardly occurs except when there is contraction of the air-passage above, the treatment must therefore be first directed to the stenosis, and only when this is fully corrected should a plastic operation be considered.

Fractures of the Larynx are usually due to compression, as in throttling, but sometimes to falls on to a hard body, like the edge of a table. They are commonest after the age of forty, when calcification has set in. The thyroid cartilage is the most frequently broken; the fracture, in cases of throttling, is usually longitudinal, but is occasionally stellate when due to a heavy impact; fracture of the cricoid is less common and more

severe. The other cartilages are not fractured by external violence.

Fracture of the larynx is not clinically a common injury, but it is possible that many cases without displacement present few symptoms and remain unrecognized. The injury produces dyspnoea, immediately afterwards from displacement, or later from swelling of the parts ; the other consequences are emphysema, haemorrhage into the air-passages, pain on swallowing and speaking, and hoarseness or aphonia ; there is often considerable shock.

If there is the slightest sign of obstruction to breathing, the air-passage should be opened ; tracheotomy may be performed and a cannula with an ascending tube (p. 188) inserted, but it is far better to do a laryngotomy and, extending the incision upwards, to expose the thyroid cartilage, reduce the displacement, and suture it in position. If there is no sign of any obstruction, tracheotomy may be dispensed with, and ice applied externally, provided that the patient can be kept under supervision ; but oedema may super-

vene so rapidly that it is safer to perform tracheotomy if the surgeon is not always within reach.

When there is extreme emphysema it may be necessary to make incisions through the skin to relieve it.

The prognosis must be guarded, for perichondritis or sudden oedema may supervene on an apparently insignificant injury. Stenosis may follow later, and must be treated on the lines laid down in Chapter VII.

Internal injuries of the larynx are rare; Moritz Schmidt¹ cites Moure as having seen three cases in which the vocal cord was torn away from the vocal process, and himself reports a case in which emphysema followed puncture of the crico-thyroid membrane with a laryngeal lancet.

Submucous haemorrhage from rupture of a vessel on the cord is not so very uncommon as the result of coughing or great strain; I have seen such a case in a consumptive patient.

Foreign Bodies.—A large body, such as a mass of unmasticated food, may lodge in the pharynx

¹ *Krankheiten der oberen Luftwege*, 3rd edition, p. 583.

or upper aperture of the larynx and cause complete obstruction to respiration. A smaller foreign body, passing into the larynx, excites spasm and causes at first urgent dyspnoea, but, when the spasm has passed off, the symptoms are a variable degree of hoarseness or aphonia, according to the size and position of the body, with cough and occasional attacks of spasm. A body which has become fixed in the larynx may cause, after the first spasm, remarkably few symptoms.

A foreign body, small enough to pass through the glottis into the trachea, may remain there, but usually, especially if rounded in shape, will enter a bronchus and become impacted. If it become fixed in the trachea the symptoms are usually slight, but if it is movable they are very characteristic; after the first spasm the patient can breathe easily, though there is discomfort, and the respirations are often noisy, but as soon as he moves the body will shift, set up a cough, and be driven against the glottis, causing a fresh attack of spasm. The substance may be ejected in this way, but usually the glottis closes too

quickly for it, and any of the spasmodic paroxysms may prove fatal.

A foreign body impacted in the larynx sets up inflammation, which may go on to abscess, perichondritis, necrosis, or stricture. The body may be loosened by suppuration and subsequently coughed up.

If it lies in the trachea, tracheitis and bronchitis will result. But it more often happens that a body which has passed the glottis is drawn into a bronchus, and usually into the right bronchus, for the septum between the two bronchi lies to the left of the middle line; it will descend into its ramifications for a distance depending upon its size. It then becomes impacted, and obstructs the entry of air to the whole or part of one lung. The movement of the chest is therefore impaired on that side, and there is absence of breath-sounds, but, at first, no dullness. If the blocking is at all complete, the affected part of the lung becomes collapsed, probably not from any ball-valve action, but because the air cannot be renewed and becomes absorbed. Inflammation is set up around the

foreign body which may be loosened and pass into the trachea and again excite laryngeal spasm. More frequent results are abscess, which may burst into the bronchi pleura or mediastinum, bronchiectasis or pneumonia.

It follows that a foreign body in the air-passages, even if causing few symptoms, must be removed as quickly as possible. When a large mass is impacted at the aperture of the larynx, it can usually be dislodged with the finger; if it cannot be removed in this way, the air-passage must be opened at once; laryngotomy is quicker and easier than tracheotomy as an emergency operation. There is no need to wait for a tube, a wire or bent hair-pin will do to retract the opening. In adults, if the body does not dangerously obstruct the breathing, and if the spasm has passed off, it should be removed under cocaine with laryngeal forceps guided by the mirror. In children, however, a high tracheotomy should be performed at once; then an attempt should be made to extract the body in the same way, if the child be over six or seven, but general anaesthesia

is advisable ; if a good view cannot be obtained, or if the child be too young, the forceps should be passed, guided by the finger. Killian's tubular speculum has proved of the greatest value in such cases as these.

If, however, the body is firmly impacted, especially if it is hard and sharp, such as a tooth-plate with hooks, much force should not be used, but, tracheotomy having been performed, packing should be introduced above the cannula and the body removed by a partial thyrotomy, avoiding, if possible, complete division of the thyroid cartilage so as to ensure the proper apposition of the cords. If the cartilage must be completely split, one of the precautions mentioned on p. 212 should be taken. It is better to push the foreign body from the wound up into the pharynx and seize it there, for it is easy to tear the cords in attempting to drag it downwards.

When the foreign body has passed into the trachea or bronchus, no attempt must be made to get it up by inverting or shaking the patient ; this will only cause the danger of laryngeal spasm.

Tracheotomy must at once be performed, and should be made low down if the body is in the bronchus or fixed in the trachea. The incision in the trachea must be large, and be immediately well retracted, while the surgeon is ready to grasp the body if it appears. The cough which follows the incision will often eject the body at once, but it has happened that it has appeared at the wound and, not being seized, has been drawn back and become impacted in a bronchus. If it does not appear, inversion and shaking may now be tried. When these measures are unsuccessful, the treatment until recently universally advised has been on the following lines:—The tracheotomy wound is kept widely open for some time in the hope that the body will be coughed up. Its position should be ascertained by skiagraphy, and, aided by the screen, attempts must then be made with long forceps, coin-catchers, or probes bent at the end, to dislodge it. The bronchi have been reached by opening the thorax from in front and from behind, and foreign bodies have been removed in this way, but I know of no such case which has

recovered. If a pulmonary abscess, or an empyema result, it may be cut down upon, and the foreign body removed, with a better chance of success, and no doubt it is better to wait for some such sequela before opening the thorax; but cases of foreign body in the bronchi, which cannot be removed by simpler methods, have been among the most hopeless in surgery.

Killian's tracheal and bronchial tube-specula have rendered much easier the treatment of these difficult cases, and numerous instances of removal of foreign bodies from the trachea and bronchi by this method have been reported. To reach the trachea the tube may be passed through the mouth, but for the bronchi, at any rate, it is better to introduce it through a tracheotomy incision. Local anaesthesia may suffice with a very tolerant adult, but usually, and especially in children, a general anaesthetic is desirable (*see* p. 11). In this way bronchi of the second, or even of the third, order may be reached, and the foreign body removed by direct inspection.

APPENDIX

FORMULAE

COLLUNARIA—NASAL WASHES

THESE are to be used luke-warm with a small nasal syringe, not a syphon-douche. While syringing the patient should breathe through the open mouth, and he should not blow the nose forcibly afterwards.

The prescriptions given here are to be diluted with twice the quantity of warm water before use.

R	Sodii bicarbonatis	.	.	.	gr. x.
	Sodii biboratis	.	.	.	gr. x.
	Acidi carbolici	.	.	.	gr. iv.
	Glycerini	.	.	.	ʒij.
	Aquam	.	.	.	ad ʒi.

R	Hazelin	.	.	.	ʒi.
	Sodii biboratis	.	.	.	gr. xv.
	Glycerini	.	.	.	ʒij.
	Aquam	.	.	.	ʒi.

R	Listerine	.	.	.	.	3i.
	Sodii bicarbonatis	.	.	.		gr. x.
	Sodii biboratis	.	.	.		gr. x.
	Glycerini	.	.	.	.	3ij.
	Aquam	.	.	.	.	ad 3i.

TROCHISCI ET PASTILLI

Lozenges are best made with fruit-paste according to the formula of the Throat Hospital Pharmacopoeia (T.H.P.). Pastils are made with a glyco-gelatine basis, and are more generally useful when a prolonged action is desired; but substances containing tannin are incompatible with this basis.

A few examples only are given below :—

R	Cocaine hydrochloride	.	.	gr. $\frac{1}{10}$ (T.H.P.)
	Tragacanth	.	.	gr. $\frac{1}{5}$
	Refined sugar	.	.	gr. $\frac{4}{5}$
	Black-currant paste	.		to gr. 20
				<i>Sedative.</i>
R	Cocaine hydrochloride	.	.	gr. $\frac{1}{10}$ (T.H.P.)
	Glyco-gelatine	.	.	to gr. 20
				<i>Sedative.</i>
R	Menthol	.	.	gr. $\frac{1}{6}$ (T.H.P.)
	Glyco-gelatine	.	.	to gr. 20
				<i>Sedative.</i>

- R Morphine acetate . . . gr. $\frac{1}{40}$ (T.H.P.)
 Bismuth carbonate . . . gr. 3
 Glycerine . . . m3
 Glyco-gelatine . . . gr. 18

Sedative.

- R Morphine hydrochloride . . . gr. $\frac{1}{36}$ (B.P.)
 Ipecacuanha . . . gr. $\frac{1}{12}$
 Tragacanth . . . gr. $\frac{1}{5}$
 Refined sugar . . . gr. $\frac{4}{5}$
 Black-currant paste . to gr. 20

Sedative.

- R Morphine tartrate . gr. $\frac{1}{40}$ (Watson Williams)
 Emetine hydrobromide gr. $\frac{1}{60}$
 Glyco-gelatine . gr. 20

Expectorant and sedative.

- R Codeine . . . gr. $\frac{1}{8}$ (Watson Williams)
 Citric acid . . . gr. $\frac{1}{2}$
 Glyco-gelatine . gr. 20

For irritable cough.

- R Heroin hydrochloride . . . gr. $\frac{1}{20}$
 Glyco-gelatine . . . gr. 20

For irritable cough.

- R Orthoform . . . gr. 2 to 5
 Glyco-gelatine . . . gr. 20

- R Ammonium chloride . . . gr. 2
 Glyco-gelatine . . . gr. 18

Stimulant.

R	Extract of Krameria	gr. 3 (T.H.P.)
	Tragacanth	gr. $\frac{1}{5}$
	Refined sugar	gr. $\frac{4}{5}$
	Red-currant paste	to gr. 20
	<i>Astringent.</i>	

R	Benzoic acid	gr. $\frac{1}{2}$
	Tragacanth	gr. $\frac{1}{5}$
	Refined sugar	gr. $\frac{4}{5}$
	Red-currant paste	to gr. 20
	<i>Stimulant.</i>	

LINCTUS

R	Heroinae hydrochloridi	gr. $1\frac{1}{2}$
	Glycerini	3ss.
	Aquam	ad 3i.
R	Liq. morphinae acetatis	℥iv.
	Acidi hydrocyanici dil. . . .	℥iij.
	Oxymel scillae	3ss.
	Aquam	ad 3i.
R	Oxymel scillae	3i. (T.H.P.)
	Syrupi rhoeados	3ij.
	Syrupi limonis	3ij.
	Syrupi tolutani	3ij.
	Glycerini	3ij.

VAPORES

One drachm is added to a pint of water at a temperature of from 130° to 140° F., and inhaled from a jug or inhaler for five to ten minutes. The

patient must remain in a warm room for half-an-hour afterwards.

The quantities of the drugs may be increased, or several may be combined; in the case of a volatile oil half a grain of light carbonate of magnesium should be used to suspend each minim of oil.

R	Tinct. benzoinae comp.	.	.	.	℥i.
					<i>Sedative.</i>
R	Acidi benzoici	.	.	.	gr. iiij. (T.H.P.)
	Kaolin	.	.	.	gr. xii.
	Trit. et adde.				
	Aquae	.	.	.	℥ss.
	Tinct. tolutani	.	.	.	℥xviii.
	Agita et adde				
	Aquam	.	.	.	ad ℥i.
					<i>Sedative.</i>
R	Menthol	.	.	.	gr. xvi. (T.H.P.)
	Spir. vini rect.	.	.	.	℥ij.
	Magnesii carb. levis	.	.	.	gr. viij.
	Aquam	.	.	.	ad ℥i.
					<i>Sedative.</i>
R	Olei pini sylvestris	.	.	.	℥xl.
	Magnesii carb. levis	.	.	.	gr. xx.
	Aquam	.	.	.	ad ℥i.
					<i>Mild stimulant.</i>

R	Creosoti	℥lxxx.
	French chalk	℥ss.
	Aquam	ad ℥i.
	<i>Stimulant.</i>	

Many other volatile oils may be employed :—

Oleum eucalypti	℥xx.
Oleum cubebae	℥xl.
Terebene	℥x.
Oleum myrti	℥v.
Oleum calami aromatici	℥v.

NEBULAE

These are used in a spray ; to reach well down the air-passages the particles must be very fine, a good atomizer is therefore required, and the spray should be breathed well in through the mouth and the nose.

Aqueous Solutions

Twenty per cent. of glycerine must be added to aqueous solutions to make them atomize well ; this is not necessary for a coarse spray for the nose or fauces.

R	Sodii bicarbonatis	gr. xv.
	Sodii baboratis	gr. xv.
	Acidi carbolici	gr. iv.
	Glycerine	℥iss.
	Aquam	ad ℥i.
	<i>Detergent.</i>	
R	Glycerini acidi tannici	℥xl.
	Glycerini	℥i.
	Aquam	ad ℥i.
	<i>Astringent.</i>	
R	Potassii permanganatis	gr. i.
	Sodii chloridi	gr. v.
	Aquam	ad ℥i.
	<i>Antiseptic.</i>	
R	Iodi	gr. vi.
	Potassii iodidi	gr. xii.
	Acidi carbolici	gr. x.
	Acidi tannici	℥ss.
	Glycerini	℥iss.
	Aquam	ad ℥i.
	<i>For chronic catarrh.</i>	
R	Chloretone	gr. v.
	Resorcin	gr. v.
	Cocaine hydrochloratis	gr. v.
	Glycerini	℥iss.
	Aquam	ad ℥i.
	<i>For acute and subacute catarrh.</i>	
R	Cocainae hydrochloratis	gr. v.
	Adrenalin chloridi (1-1,000)	℥xliv.

Glycerini ʒij.
 Aquam ad ʒi.

For catarrh in singers.

The following astringents may be used : Zinc chloride, gr. x. ; zinc sulphate, gr. x. ; perchloride of iron, gr. v. ; alum, gr. xv. to the ounce.

Oily Solutions.

These are of more general application to the larynx.

R Menthol gr. xv. ad xxx.
 Paraffinum liquidum ad ʒi.

R Menthol gr. xv.
 Camphor gr. iiss.
 Chloretone gr. v.
 Paraffinum liquidum ad ʒi.

The more stimulating volatile oils may be used in the same strength to the ounce as are given under vapours. Cocaine alkaloid may be employed in a strength of 1 per cent. with oleic acid ℥xv. to dissolve it. Other drugs are also used, such as : Creosote ʒi ; iodine, gr. v. ; carbolic acid, gr. v. ; thymol, gr. v. ; oleum gaultheriae, ℥xv., and many others.

PIGMENTA

These are to be applied by the surgeon with a cotton-wool mop under guidance with the laryngoscope. The strong escharotics are intended for singers' nodules, the bases of papillomata, etc., and must be applied with great care only to the parts affected. The applications for tuberculous laryngitis must be well and firmly rubbed in with a strong cotton-wool holder.

The wool should be thoroughly wetted with the solution, all excess being removed by a sharp flick, lest any fall into the trachea.

For Chronic Laryngitis—

R	Zinc chloride . . .	10 to 30 grs.	Water, 1 oz.
R	Zinc sulphate . . .	15 to 60 grs.	„ 1 oz.
R	Copper sulphate . . .	10 to 20 grs.	„ 1 oz.
R	Perchloride of iron . . .	60 to 120 grs.	„ 1 oz.
R	Silver nitrate . . .	10 to 60 grs.	„ 1 oz.
R	Resorcin . . .	96 grs.	Glycerine of borax, 1 oz. (T.H.P.)
R	Iodine . . .	6 grs.	
	Potassium iodide . . .	12 grs.	
	Oil of peppermint . . .	5 ℥	
	Glycerine . . .	1 oz.	

“*Mandl's solution.*” *Stimulant.*

Escharotics—

- R Silver nitrate (solid, fused on a probe).
 R Salicylic acid, 5 to 30 grs. Rectified spirit, 1 oz.
 R Formalin (40% formaldehyde), 10 to 30 per cent.
 in glycerine.

For Tuberculous Laryngitis—

- R Lactic acid (B.P.) 20 to 100 parts.
 Water to 100 „
- R Lactic acid 50 parts (Lake).
 Formalin 7 „
 Carbolic acid 10 „
 Water to 100 „
- R Phenol sulphoricinate 40 parts (Ruault).
 Water to 100 „

INSUFFLATIONS.

These are best applied to the larynx by means of a curved insufflator directed by the mirror. They may also be used by the patient by “auto-insufflation”; the powder is placed in one end of a straight glass tube, the other end of which is put far back into the mouth, a sharp inspiration will then direct the powder to the larynx.

This is a valuable method for the application of analgesics.

R	Orthoform	.	.	.	3 to 5 grs.
R	Orthoform	.	.	.	2 grs.
	Amyloform or				
	Iodol or				
	Iodoform or				
	Resorcin	.	.	.	1 gr.
R	Morphine hydrochlorate	.	.	.	$\frac{1}{10}$ to $\frac{1}{2}$ gr.
	Amyli	.	.	.	2 grs.
R	Cocaine hydrochlorate	.	.	.	$\frac{1}{4}$ gr. (Fasano)
	Guiacol sulphocarbolate	.	.	.	$\frac{1}{2}$ gr.
	Boric acid	.	.	.	$2\frac{1}{2}$ grs.
R	Hydrargyri cum creta	.	.	.	1 gr.
	Tragacanth	.	.	.	2 grs.

For syphilitic ulceration.

INTRATRACHEAL INJECTIONS

These are intended chiefly for tuberculous ulceration and for laryngitis sicca and atrophica.

The temperature of the solution should be 90° F., about half an ounce should be injected at a time ; the syringe must be guided by the mirror and

passed below the cords; the injection is made slowly while the patient takes a deep inspiration.

- | | | |
|---|-----------------------|-------------------------------|
| R | Naphthalene | 3 parts. |
| | Liquid paraffin . . . | to 100 „ |
| R | Creolin, or | |
| | Izal, or | |
| | Guiacol | 2 parts. |
| | Lanoline | 7 parts. |
| | Liquid paraffin . . . | to 100 parts. |
| R | Menthol | 1 to 20 parts. |
| | Liquid paraffin . . . | to 100 parts. |
| R | Menthol | .1 to 15 parts (Freudenthal). |
| | Almond oil | 30 „ |
| | Yolk of egg | 25 „ |
| | Orthoform | 12 „ |
| | Water | to 100 „ |

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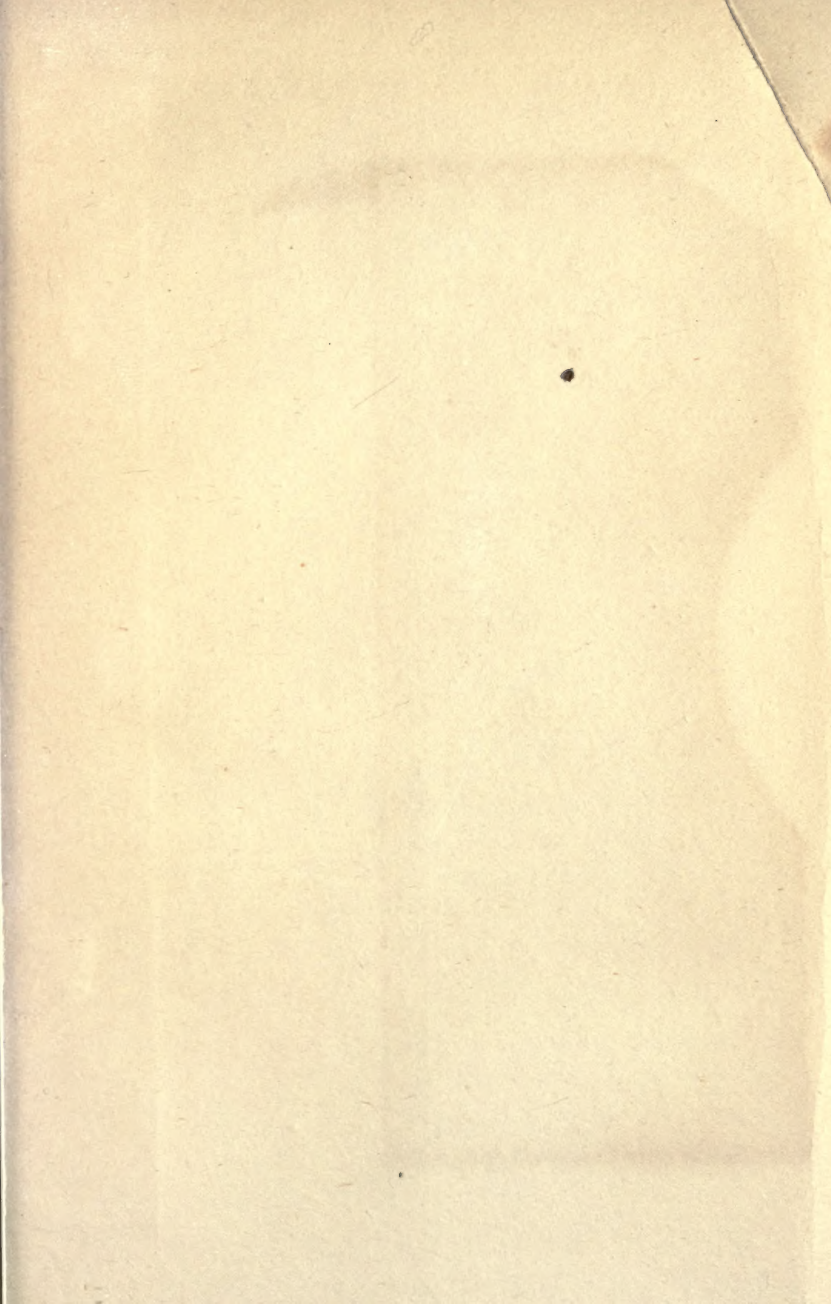
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